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ANNEALING PAVING BRICK.

RECENTLY there has been considerable letter-writing and discussion on the vitrification of brick, especially those intended for paving. Some contend for thorough vitrification, while others maintain that semi, or say partial, vitrification is all that is needed for good paving brick. This has been so thoroughly discussed at conventions and in the clay journals that I do not see much chance of writing anything new on the subject, but the impression forces itself upon me that when the term "vitrifaction" is clearly understood all round, discussion on the subject will to a great extent cease.

There is also another matter in connection with vitrified brick that appears to be to a great extent overlooked, which may account for the diversity of opinion so prevalent. That is the matter of annealing brick. The term "annealing" appears also to be shrouded in misconceptions and requires the same unanimity as to its meaning as the term vitrifaction. By consulting the dictionary we find—"Anneal, v. a., to temper glass or metals by subjecting them to intense heat and then letting them cool very slowly; to heat glass and earthenware so as to fix colors; to temper by heat; to bake, as tiles (A. S. *an*, and—*oelan*, to burn)."

From a practical standpoint of view this definition is rather vague. Tempering and annealing metals are two very different things, I might say opposite things. Take steel for instance, where we temper to impart hardness, but we anneal to make it soft. The object of annealing metals is to deprive them of brittleness and to render them flexible and ductile.

We will take the liberty of cutting out "tempering" from this definition of annealing and give it a place by itself, and for the

present deal with annealing as generally practiced and understood. One portion of the definition is to the point and quite satisfactory to me, viz., "by subjecting them to intense heat (the glass or metals) and then letting them *cool slowly.*" The italics are mine. I attach more importance to the slow cooling than anything else, this is what effects the annealing. Raising to a very high temperature is of no avail in annealing, if the slow cooling is not attended to, and it is astonishing what results may be attained when this cooling off is properly done; nails that would not bend to an angle of 90 degrees without fracture before annealing, could be tied into a close knot after annealing. In the Industrial Exhibition of 1861 might be seen a railway car axle tied into a knot; this was done cold after being annealed for one week. I say cold, but allowance must be made for the heat developed during the process of tying the knot.

Nearly all the metals are possessed of this property of softening by very slow cooling from a high temperature, care being taken, however, to exclude the air by imbedding the metal in some kind of powdered material; sand is very good for iron and steel, but it might be injurious to some of the metals. Powdered charcoal would probably do for some of the metals, but would frustrate the object in view if it were used to imbed iron or steel.

A little reflection leads us to the conclusion that steel and iron would be hardened by such treatment, and practice confirms this conclusion. The mistake has frequently been made of trying to soften or anneal wire and sheet iron by bedding them in saw dust and raising a heat on them, then letting it die out slowly. The result—spoiled wire and sheets—is always the same. This has occurred in establishments where steel making by the "cementation" process was carried on daily under the very noses of these misguided annealers. It never occurred to these men that the saw dust would soon char and would then convert into steel the iron in contact with it. Of course a man with ordinary intelligence does not fall into this error twice.

From instances of this kind we readily see that annealing is beset with conditions, besides slow cooling, and is not so simple an affair as it at first appears .The metal copper just reverses the operation; to anneal or soften copper it must be heated to a red heat and

plunged into cold water. This renders it soft and pliable. Slow cooling hardens and stiffens it.

Glass comes under the same law as the generality of metals, and requires slow cooling to render it tough and elastic.

The Siemens Bros. offered railway companies glass "sleepers," or "ties," for their railroads, to replace the wooden tie, and it was claimed that the advantages gained by the glass tie would doubly compensate the railway companies over the difference in cost. They were to be strong and tough enough to resist all ordinary shocks and strains, and as far as deterioration from decay, etc., they were practically indestructible. The possibility of producing glass ties with such flexible properties centers chiefly in the annealing, and this leads me to the subject of this article, "Annealing Paving Brick."

If we desire to establish and maintain the reputation of brick paved streets and roadways, we must endeavor to endow the brick with all the good properties of granite, and if possible deprive it (the brick) of all the granite's objectionable features.

In the first place let us examine the characteristics of the modern, or up to date, paving brick, and do we not find it to resemble granite to a great extent in both character and composition? Would it be much out of place to call it artificial granite? The object sought and aimed for by the maker of vitreous brick is to return the clay to nearly its original state as rock, and he uses nature's method of doing it, viz, by heat, but his modification of the process will not admit of heating up to melting point, because his brick are already formed or molded. Over forty years ago I saw a process of brick-making in which the liquid (molten) clay was run into molds and set aside to anneal; the process was abandoned on commercial grounds. I see, every now and then, the same thing crops up again, and I firmly believe it will yet bear fruit. The process referred to is the utilization of blast furnace slag. The one I refer to specially was at furnaces smelting what is known as *clay* iron-stones. These lava bricks were put on the market to compete with the common building brick, which proved fatal to them, chiefly on account of their weight and the consequent heavy freightage. No particular pains was taken in cooling them. They received a moderate covering of dry sand. When I think over this long-ago experiment it

occurs to me that if brick paving had at that time received the impetus of the present time the lava brick would in all probability have been made into excellent paving brick. This would have left no question as to its vitrifaction, and, with proper annealing, a tough and almost everlasting paver would have been made. The composition differed somewhat from the paver of to-day, inasmuch as it contained a percentage of lime that would render the usual method of brickmaking impossible. Compare the analysis of the vitreous paver and the lava brick :

	Vitreous.	Lava.
Silica	57.47	39.82
Alumina	32.69	15.10
Lime	1.85	31.48
Protoxide iron	4.01	0.79
Sulphide calcium	....	2.22
Magnesia	2.11	7.44
Protoxide manganese	....	1.62
Phosphoric acid	....	.15
Alkalies	1.96	1.89
	100.06	100.51

What confirms me in my belief about the slag paver is the fact that the slag was used far and wide to macadamize the roads, turnpikes, etc., and a good, solid road it made. A few houses were built, some twenty or more, of the large broken-up blocks. These were an experiment with the material, and it looks as well to-day as it did thirty years ago. The only draw-back to it was the cost of building. No attempt was ever made to anneal any of these large blocks of slag. They were run into iron moulds and sent to the dump as soon as they were set.

While writing this article I received by mail a neatly got up and well-written pamphlet, entitled "Brick and Brick Roadways," by W. S. Ravenscroft and H. A. Miller, and while complimenting them on the plain, practical way they handle the subjects treated of, I must take exception to the half off-handed style in which they treat annealing ; yet they are careful enough to lay down conditions that will insure annealing. They say, "The cooling off of a kiln should be very gradual, as the admission of cool air in the slightest degree has a tendency injurious to any brick, and especially to pav-

ing brick." Again they say, "It is our belief and experience that when the burning of a brick has been finished it is as tough as it is possible to make it, and that the only thing necessary is to see that the cooling process is not too rapid."

Here Messrs. Ravenscroft and Miller and I just agree. A brick, and especially a vitreous brick, is exceedingly tough when it reaches its final temperature, and the slow cooling recommended is to retain a portion of that toughness. The present method of manufacturing brick renders reheating unnecessary, but with the metals and glass reheating several times is sometimes necessary. If brick had to be reheated as much care would be needed for the heating as for the cooling; a quick reheating of brick would be as mischievous as quickly cooling off the first heating.

If Messrs. Ravenscroft and Miller consider it requisite to reheat, in order to anneal, and which may be inferred from the indifference they manifest towards it, or if they think that heating is the factor of main importance in annealing, then I beg to differ on both points. Brick, glass or metals may be carefully heated to any prescribed temperature and the annealing completely spoiled by the quick cooling. This they admit, but appear to confound cause with effect; they ignore annealing but prescribe that which will produce it.

And now let us consider the kiln that is most suitable for producing vitreous paving brick. Any good close-topped kiln that is not used to heat the air for the adjoining kiln. I think the continuous kilns unsuitable for good paving brick on account of the air being drawn through the hot finished brick and hastening the cooling of them; of course this saves fuel, but it undoubtedly spoils brick. My experience in metals confirms the statement of Messrs. Ravenscroft and Miller about the injurious effect of admitting air even "in the slightest degree."

From the above considerations we may conclude that merely vitrifying brick does not constitute them good pavers, and brick of the finest composition receiving the most careful and skillful treatment at the hands of the burner may be utterly spoiled by injudicious cooling, in order to save a little time or a few barrowfuls of fuel.

W. Waplington.

W. WAPLINGTON was born at Somercotes, Derbyshire, Eng., February 19, 1835. His father was a mining contractor, and took him into the mines when just turned nine years of age. Up to that time his education had been what the national schools in England then afforded. His mining experience was gained in the North of England, in the Marquis of Londonderry's collieries in the County of Durham. In 1856 he quit mining and turned his attention to the forge, foundry and rolling mills, and had the pleasure of witnessing the early experiments of Bessemer & Siemens in steel making, and about this time he commenced contributions to the local papers and to *London Engineering*. In the latter paper he commenced a discussion with the late Sir W. Siemens on the chemistry of puddling iron. During his mining days he was a diligent attendant at the night schools and scientific lectures. He was also passionately fond of music, and got fairly grounded in this delightful art under Mr. Joseph Kay, a basso chorister and teacher in Durham Cathedral. From 1856 to 1866 he was in the foundries and rolling mills of the Butterlay Company at Codnor Park, Derbyshire. He then went to the Atlas Steel Works of John Brown & Co., Limited, and was there six years, acquiring a knowledge of steel and armor-plate making, holding the position of assistant manager. In 1872 he took charge of the Lancashire Steel Works, operated at that time by Bolchow, Vaughan & Co., Middlesborough. In 1874 he was engaged by the Bessemer Steel and Ordnance Co., London, as manager and chemist at their works, East Greenwich. They closed down just before the end of the year, and he was at once engaged as technical manager to the Steel Company of Canada, the works to be built at Londonderry, Nova Scotia. Thither he was sent in June, 1875. In 1881 he came to the United States to build and take charge of a Bessemer steel plant at Wheatland, Pa., which never matured. From 1882 to 1884 he had no permanent position. At this time the Hon. E. A. Wheeler, of the Wheeler Iron Company, offered him the position of manager at their rolling mills, West Middlesex, and then offered him a partnership if they could lease the mills from his partner, Lloyd Reed. This they did, but before the end of 1886 Mr. Reed saw a good chance to sell the mills, etc., and for a consideration they allowed the lease to be cancelled. Since that time he has been giving his attention to the generation of heat by gaseous fuel, etc.

WIDTH OF PAVED ROADWAY IN CITY STREETS.

THE most serious obstacle in the way of securing well paved streets in all our cities and towns is the great cost of such improvements and the unwillingness of the people to bear the burden of taxes and assessments necessary to pay for them. It is, of course, a fact that such burdens are rather fancied than real, since, in nine cases out of ten, a well-paved street is a good business investment for the property owners along it, but it is very difficult to get the average citizen to see it in that light; and while he can but admit that well-paved streets are a blessing, he usually regards the collection of assessments for such improvements an infringement on his liberty, or a species of legalized confiscation of his property.

It being universally admitted that well-paved streets are—bar-

ring the fact that they must be paid for—desirable, and in fact necessary for the comfort of urban residents, it becomes an interesting problem how to reconcile the warring elements of cost and comfort, or in other words, how to secure well-paved streets at a reasonable cost.

Unfortunately, good pavements of whatever kind, like most other good things, are expensive, and the property owner is not generally able to withstand the temptation to favor an inferior article because it is cheap. As a consequence, few cities have escaped the curse of miles of so-called pavements constructed in the shabbiest manner out of the poorest materials, having no other virtue than low firstcost, but proving in the end so expensive that only the wealthiest communities can afford them.

As one possible solution of the problem, how to secure well-paved streets at a reasonable cost, the possibility and propriety of reducing the width of the roadway is suggested. Most of our American cities and towns have been laid out with streets of liberal width. This is particularly true of those parts of cities devoted to residence purposes. Wide streets are desirable for the free admission of air and light, and for their æsthetic effects. But the primary and principal function of streets is to afford means of intercommunication between the different parts of a city, and aside from the considerations named above, the width of any street should be determined by the requirements of such intercommunication, or in other words, by the amount of travel it is required to accommodate. Judged by this standard, any observant person must admit that the majority of the suburban and residence streets of our cities are unnecessarily wide. Viewed from this standpoint, it seems preposterous to provide a pavement forty or fifty feet wide to accommodate the few light and infrequent vehicles of the residents, and the occasional trips of the milk, ice and grocers' wagons that supply the people with the necessaries of urban life.

The question will naturally arise, why not, while securing the benefits of wide streets, make the paved portion of them conform to the requirements of travel?

Quite extensive observation has convinced the writer that a roadway from eighteen to twenty-four feet wide is ample to accommodate the travel that passes over the great majority of residence and suburban streets in American cities. There are, of course, in

every city, a number of principal roads or driveways where wide roadways are necessary, but if one will consider the matter he will be surprised at the small number of such heavily traveled streets outside of the business portion of any given city; and if he will take pains to observe the amount of travel passing over streets other than such main arteries, he will be surprised at the smallness of its volume.

It may be stated as the average practice in American cities to make the roadway three-fifths of the total width of the street. This gives for a sixty foot street a roadway thirty-six feet wide, and it is customary, when the street is to be improved, to have the whole width of this roadway paved, regardless of whether it is or is not necessary to properly accommodate the travel to which the street is to be subjected.

It seems to the writer that this practice is a needless extravagance and a waste of public funds. In the case of at least four out of five such streets, not principal driveways or popular boulevards, a paved roadway eighteen feet wide will be found amply sufficient to meet all the requirements. The arguments in favor of reducing the roadway width on such a street from thirty-six to eighteen feet may be briefly stated as follows:

1st. Because the cost of paving the street is reduced one-half; and because of such reduction, it will be found easier to get the property owners to consent to the construction of a first-class pavement.

2d. The cost of cleaning or sprinkling the street is reduced one-half, or, in case it is not cleaned, there is only one-half the surface to supply the dust and dirt to be carried into the houses by the wind.

3d. While the cost of maintenance and repairs might not be reduced in proportion to the width, since such cost in the case of pavements not subject to natural decay is a function of the amount of travel over them, there can be no doubt that the cost of such maintenance and repairs would be greatly reduced.

4th. The narrow pavement leaves a wide space on each side of the street, which, after providing for ample sidewalks, may be sodded with grass or planted with trees, thus greatly increasing the beauty and comfort of the street, and practically adding to the front depth of abutting lots.

5th. There will be ample space between the curb and the side-

walk in which to lay all sewer, water and gas pipes, where they will be readily accessible for repairs without cutting into and disturbing the paved roadway.

This is a most important consideration, which I need not discuss in detail. As this plan contemplates placing a line of such pipes on each side of the street, it may be claimed that the cost of such pipes would be doubled. This would not be true, since not only would the pipes for the double system be smaller and cost less to lay, but the house connections would all be materially shortened, and their cost reduced, and the saving on the large number of these connections would probably more than balance the extra cost of the double lines of pipe.

6th. A paved roadway eighteen feet wide will allow two lines of vehicles to meet or pass each other freely. It is objected that teams could not be turned round in such a street. This is admitted (though it is not impossible for a skillful driver to turn a one-horse vehicle in a street eighteen feet wide between curbs), but if circular curbs, say of twelve feet radius are used at the corners, there will be ample room to turn at the street intersections; and even if drivers found it necessary to go around a square to make the turn, it would not be a serious inconvenience.

These advantages and the great economy that would result from the adoption of the plan make it worthy of more careful consideration than it has heretofore received.

Many people who habitually oppose innovations, whether they are meritorious or not, will resist the making of such narrow driveways, simply because it is not the "good old way." But if the plan is found to possess the merits claimed above, and no more serious objections to it appear than now occur to the writer, it is certain, like all other meritorious things, to be adopted in the end.

It is not, of course, claimed that the idea is new, or that it originated with the writer, but it has not heretofore received the attention it deserves, and it is with the hope of securing such attention and a full discussion of the subject that this paper is presented.

S. Whinery.

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THE GRAVEL ROAD MOVEMENT IN PARKE COUNTY, INDIANA.

PARKE COUNTY, Indiana, was organized by the legislature in 1821. It contains 440 square miles. About three-fourths of the area is level, or gently rolling. The remaining fourth presents every aspect from gently sloping to precipice.

When the county was first settled, road workers were few, and it was all they could do to cut the timber out of the roadway, and corduroy a few unavoidable swamps. It was more than they could do to grade up the road beds. In order to get the driest road bed, the summits of the ridges were followed as long as they held out, then the travel plunged down their steep ends into the little valleys. Ox teems were generally used, horses being used mainly for riding. The policy was to put enough oxen to a load to draw it, and to break down all obstacles in the way. I have in the last year or two seen walnut logs sawed into lumber of less diameter than the early settlers often used for wagon and sled tongues. The young man who could drive three to six yoke of oxen, and crack his whip till it could be heard a mile, and swear till he shook the acorns from the oaks, was a neighborhood aristocrat, and could have the hand of the prettiest girl in the puncheon floor dances.

Those rude, primary trails, were by time and use worn into the principal roads. Houses and other improvements were built with reference to them, so that it has generally been impossible to relocate them. Travel across our county in any direction and we see roads of the worst possible location for us of to-day; but they were the only available locations for the early settlers, who could do no better.

After about twenty-five years, the practice of changing roads so as to conform to land and section lines began to prevail. This, in the rough country, did the roads more harm than the original bad locations. I know numerous instances where, to conform to a road line, the road now runs over the end of a ridge, or the swell of a hillside, where the distance around it would be less, and give incomparably better gradients.

As farms were improved our roads were confined to the lanes. Then the impassable mud holes were developed. Rails would be

taken from fences to pry up mired wagons, and left in the mud holes where used till they became dangerous to subsequent teams; then fences would be opened and the travel would cross the adjacent fields as regardless of the protests of land-owners as would the floods of our rivers the protests of bottom farmers.

Until the session of 1876–7 our legislature gave us no free gravel road laws. Before that time we had toll road laws only. The first toll road through Parke county was the Indianapolis and Springfield plank road, which was finished to the Wabash river in 1851. It was delightful while it lasted as a road, which was about five years. It lasted as a nuisance about five years more. Because it was chartered as a plank road it had to be a plank road. It was like the boy who went fishing for cat. The first bite he got was from a four-pound bass. He took it off his hook and flung it back into the stream, saying: "When I go a catting, I go a catting." That plank road in many places was built alongside of gravel banks and gravel bars, where one cast of the shovel would have put the gravel on the road, where it would to-day be doing service. The last mile and a half was planked on the Wabash second bottom over as good gravel as was ever placed on a road, and which we now haul three to four miles to make gravel roads. But the stockholders and directors were a plank roading, and it was idle for a bass to bite their hook.

How much we do from the force of habit. Our people have at last got into the habit of hauling gravel onto the common roads; and this fall I saw farmers working out their road tax by hauling gravel from a pit and dropping it onto a road-bed composed of better gravel than they were hauling three-quarters of a mile. In addition to the force of habit, the fact that a farmer is limited in his work to his own road district causes some of these absurd actions. In his own district the roads may not need the gravel; but as he would get no road tax credit if he should haul into another district where his gravel might be needed, causes him to do needless work in his own. As he has team, wagon and time, he prefers working out his tax to paying money, only to be paid out to others by the supervision for the same useless work.

If any county in the state ever had worse roads in the rainy season than Parke county I am glad I never saw them. As roads in the rough, or raw, as we might properly say, were good at the time

in the year when farmers were too busy with farm work to travel them much, and bad at the only time they had to spare, neighbors' acquaintance with neighbors was of necessity very much restricted. The area of each family's range was generally limited to the distance the members could walk of a night across fields and woods to a school-house or "meeting-house." With such a limited association each neighborhood had litle knowledge of the ways and customs of others, and of course they "judged themselves by themselves." Their knowledge of things, and their ways of doing, were the ways by which all the rest of the world should be squared. There was little or no social harmony between town and country. The "country Jake," as he dragged himself through his road mud-holes into the village, looked like a mud-turtle. There he met the village dandy, tip-toeing along over his split-log sidewalks with his shining boots, who represented the dry-land terrapin. Of course there grew up and remained that inevitable and irrepressible distinction between the clean and the dirty. The "country Jake" resented this manifest distinction with rude actions and scowls, and was answered by the village "Chawley" with sneers and contempt.

Our numerous gravel roads have done away with nearly all I have here described, and which I well remember to have existed when I was a boy and young man. Country and town have become homogeneous in Parke county. A carriage load of villagers will sail out into the country and take dinner or tea with a farmer's family, and the visit will in due time be returned.

The gravel-road movement in Parke county had the smallest possible beginning. About the year 1863, when the whole country thought of little else than war, Hon. Thomas N. Rice, a lawyer of Rockville, was elected road supervisor, mainly as a joke. Four road districts then cornered at the court-house in Rockville, and the streets were worked simply as common roads. Mr. Rice did not want the office at first. He had a good split-log sidewalk from the court-house to his residence, and the flat sides were up, and some of them were fully fifteen inches broad on their face. The grace with which he could tip-toe over these logs and spring from one to another would have provoked the envy of a dancing-master if there had been one. What did he care for that elongated mud-hole called a road or the "country Jake" who waded it?

After he had taken that solemn oath of office, an idea struck him.

He would play the people a joke which would never become stale, for the older it grew the more it would be enjoyed. He would not call out the hands, or assign any work to any person by which he could pay his property road-tax, but he would let the money accumulate. The next year he sought the office and was triumphantly elected. He again held back the work, and allowed another year's road tax to be paid into the treasury. Then the word got out that he had nearly $300 road money in his possession which the honest toilers had paid into the treasury. What did he mean? Did he intend to skip the country? A great storm of indignation raged. When he found he could not be re-elected, he induced a friend who was onto the secret to allow his name to be used, and if elected to fail to qualify, when Mr. Rice would be appointed. His friend was elected over him by a majority compared with which Cleveland's is insignificant. The storm of opposition spent its force at the election. The successful candidate declined to serve, and Mr. Rice was appointed supervisor. He continued his former policy, and at the end of the year had over $400 on hand. He then solicited the property-owners on Howard avenue in Rockville to donate to his enterprise twenty cents per lineal foot of their ground, which most of them did. Before his term expired he let a contract to grade and gravel that street twelve feet wide and one foot deep for nearly a half mile. The storm of protests and indignation which then greeted Mr. Rice from those on other streets and alleys in the same road district now seem ridiculous in the highest degree. But their points were then considered well taken by the grumbling public.

Mr. Rice and a half-dozen others, his disciples, took a spade and examined the bars on Williams creek to see if enough gravel could be obtained. They thought by careful shoveling it could be had. It is historically well attested that this was done on a Sunday afternoon. Mr. Rice is now a prominent and zealous churchman. Even then he was not above suspicion of having church tendencies. But no Sunday's work he ever did has resulted in more good to this world than did the examination of those gravel bars. Of the value of his later abundant Sunday-school work to be measured where the streets are paved with gold it is yet too early to judge; but he is known here where all can walk safe on his gravel.

Every community has a wise and general purpose man. This man took a pencil and a shingle when the first street was to be graveled

and demonstrated that the bars of Williams creek could not contain gravel enough to gravel Howard avenue twelve feet wide and one foot deep. Beside that, what was the use of graveling one street when all the others of necessity must do without it? Then the grumblers called attention to the fact that Mr. Rice had done all this work on the street on which he resided. He would have been denounced none the less had he graveled any other street instead of his own. I had not then grown into the importance of being a surveyor and civil engineer. I was only county treasurer, a circumstance due to a badly aimed shot from the confederate army which failed to kill me. I desired a re-election, and it was important that I should prove that I was smart in figures. I joined the objectors, and where the wise man had figured out a probable deficiency of gravel, I figured it out absolutely so. Bad as my figures were afterward proven to be, they were clearly the best to be made at that stage of the campaign. While we were demonstrating, objecting and croaking, Mr. Rice built his road. But we still had something left to growl about. The gravel was put on while other roads were dry and hard, and the loose gravel made it hard pulling while it was packing. We growled on till the fall rains made all other roads impassable, and this road good. Then ended all the glory of the opposition. That was the first attempt at gravel road building in Parke county. After the next flood all the bars on Williams creek were refilled. We have since graveled about eleven miles of road and street from those bars, and to-day we can't see that a pebble is missed.

The next effort at graveling was the north and east side of the public square. Mr. Rice took a leading part in that movement also. This work was put through under the law for assessing the property holders on each side of the street. It was hard coaxing to get the county commissioners to see that the county was liable to pay its share of the work. The then leading commissioner voted against the appropriation, and placed a protest on record. He has long since been a very pronounced friend of gravel roads, and would doubtless read that protest now with a blush.

About a year later, to wit, about 1866, Dr. H. J. Rice (brother of the former) and Joseph L. Boyd circulated a petition to build a gravel road from Rockville to Bellmore, a village seven miles due east. It was built under a law then in force taxing the land three

quarters of a mile on each side of the road, each land owner being a stockholder to the amount of his tax. Such a road became free in twenty years. The petition was very defective, and the proceedings in the court were also erroneous; but the construction was rushed through so rapidly that it was an accomplished fact before the objectors could growl up an organized opposition. If it had been undertaken a year later, when the reaction against gravel roads was on, it could easily have been defeated.

The next move was to grade, gutter and gravel Ohio street from the public square to the next street east. I took the lead in that small movement. It was done under the law to assess property owners on each side. I had then been fully converted to the practicability of gravel roads.

The year 1867 an effort was made to build a gravel road from Rockville seven miles north to Annapolis. Stock was subscribed and a company organized under the turn-pike law. It was partly constructed, when a law was passed allowing roads to tax the land one and a half miles on each side and from the termini. I think the law permitted roads partly constructed to tack about and finish under that law. At any rate that was attempted. It reached out so far on side and end that it took in people who had but little interest in the road, who became objectors, and especially there grew up a contention whether a road had a beginning and an end, or whether it had two ends. The right to tax one and a half miles from the "termini," as the law provided, gave rise to that discussion. When a gravel road falls into the hands of a debating society that road is doomed. This road passed through Bloomingdale, the then intellectual center of Parke county. While there were very few there who could take one share of stock at fifty dollars and pay it up, there was no end to those who could give wagon loads of advice, worth ten thousand dollars to any enterprise; and they gave it freely. While very little of this advice helped the cause of the road, it nearly all gave a deal of trouble and annoyance to the opposite side. All these parties were for the gravel road, but not one but would for all coming time wade through deeper mud than he had ever seen before he would have a road built on the plan and by the means proposed by the opposite side. At last five persons proposed to take the road and complete it, provided the

original stockholders would abandon their stock and allow the five to own the road when done. All were tired and agreed. I personally lost one hundred and fifty dollars by that road.

In the meantime the citizens of Rockville went on graveling their other streets, till all the principal ones were completed to the corporation line.

An effort was made in 1868 and 1869 to build a road from Bellmore via Hollenburg and Portland Mills to Russellville in Putnam county, under the law taxing one and a half miles on each side and beyond the "termini," as before mentioned. This road ran several miles on the county line, and this added some subjects for the debating society to discuss. Hon. Thomas N. Rice, before mentioned, was one of the attorneys employed by the objectors to defeat the road. It was interesting to listen to his arguments against this road, as an attorney, and contrast them with the arguments he had formerly used as supervisor. This road dragged along in court a year or two and died. That long discussion as to whether a road had a beginning and an end, or whether it had two ends, was all gone over again, and hairs were split finer than cobweb threads.

One of the means used to kill the last mentioned road was a stock company road, organized to occupy and claim part of the same right of way claimed by the former. When the former died, the latter died also and was buried in the same grave.

J. T. Campbell.

CAPT. JOHN T. CAMPBELL, of Rockville, Indiana, was born in Parke county, one and a half miles east of Montezuma, May 21, 1833. He attended two terms of the then locally famous Bloomingdale Academy, under Prof. B. C. Hobbs. When the rebellion broke out he volunteered in the 14th Indiana Infantry, and was twice rejected for defective teeth. Later, a permit was granted to raise the 19th, 20th and 21st regiments, Indiana volunteers, and he was elected and commissioned captain of Company H., 21st Indiana Volunteer Infantry, July 6, 1861. He was wounded in the battle at Baton Rouge, August 5, 1862, from which he still suffers. He was appointed assistant provost marshal under Captain Thompson (later Secretary of Navy under Hayes). In 1863 he was elected county treasurer of Parke, his native county, and re-elected in 1865. December 15, 1864, he married his second cousin, Annie Butterfield, in Butler county, Ohio. While riding with her there, he saw some very fine turnpikes and gravel roads. She claims, and justly so, no small share in the glory of raising Parke county out of the deepest mud on to the best and most numerous gravel roads of any county in America, as she largely converted their most active promoter to the cause of good roads. She constantly reminded him of the difference between his rides with her in Ohio, and her rides with him in Parke

county, Indiana. Before his acquaintance with her he thought the only remedy for mud roads was stronger vehicles and bigger horses. After his conversion to good roads he worked, urged, argued, demonstrated and wrote in the county papers for better roads, and suggested routes. Many times he thought his agitation made no impression on the people, but after the passage of the free gravel road law of 1877, Parke county had an epidemic of gravel road building. The fact that adjoining counties having the same law and equal material, yet building no gravel roads, is proof that his agitation had prepared the minds of Parke county people for the improvement.

In 1871 he matured a radical and complete road system in statutory form, on which he took out a copyright, but offered it free to Indiana if the legislature would adopt it as a whole. The session of 1871 would doubtless have passed it but for the bolt of the house on account of political measures. The senate committee reported it favorably and the house committee signified their intention to so report. He offered it to five subsequent legislatures on the same terms, but each session showed less and less disposition to adopt it. A legislature is a queer thing; it seems that the best work they ever do is by accident or inadvertence. If a live measure is actively considered, it developes a conservative opposition that defeats it. The English Parliament established the freedom of the press in England by forgetting to put on a new muzzle when the old one had dropped off by the statutes of limitation. Before another Parliament met England discovered that a free press was better than a muzzled press. Let us hope that at no distant time, some legislature will stumble onto a good road law, for they seem determined never to step onto one purposely.

MUNICIPAL OWNERSHIP OF STREET LIGHTING PLANTS.

A COMMITTEE, composed of N. B. Acheson, Edward McGinnis, H. B. Chase, George Welsch, J. L. Botsford, Peter Deibel and J. W. Dickey, was appointed recently by the common council of Youngstown, Ohio, to investigate the municipal ownership of electric street lighting plants in cities of about the population of Youngstown. The committee did its work thoroughly and made a valuable report. From the information gathered a very comprehensive table was compiled of which the accompanying exhibit is the most essential part.

In submitting the report the committee said:

"We find that there are at least one hundred and twenty cities in the United States that own their own electric lighting plants, and as such are profitable to those cities, and that one out of fifteen of the total number of electric lighting plants in this country are municipal institutions. We find that New York City, Boston, Chicago and Detroit, as well as smaller cities, are at present making investigations in this line. We have written to all of those cities that own their electric lighting plants that we could hear of, asking of each a list of questions calculated to gain the desired information, and have received replies from seventy-three, which we have at-

ELECTRIC LIGHTING PLANTS OWNED BY CITIES.

NAME OF TOWN.	System in Use.	No. of Arc Lights.	Candle Power.	Is Plant operated in connection with other works?	Fuel used.	Cost.	Cost of the Plant.	Incandescent Lights for private use.	Charge for them.	Number in use.	Arc Lights cost the city each per year.	Was city furnished Electric light by private corporat'n previous to owning its own plant?	What did you pay per light for same?	Do your citizens believe it wise for the city to own the plant?
Atlantic, Iowa	Slatry	....	.....	No	Coal	$1 35	$25000 00	Yes	.....	1500	.....	No	.....	*....
Albany, Mo	Westinghouse	30	1200	"	Wood	2 00	11000 00	"	*.....	1000	0	"	.....	Yes
Alexandria, Va	Schuyler	92	1500	Yes	Coal	3 07	16000 00	No	.....	.....	$55 00	"	.....	"
Alexandria, Minn	T. & H.	10	1200	"	Wood	2 00	6000 00	Yes	65c	ov'r 600	about 7 00	Yes	120 00	"
Arlington, Minn	Edison	4	1200	"	"	.....	28000 00	"	75c	100	200 00	No	.....	....
Ashtabula, Ohio	Westinghouse	120	500–2	No	Coal	2 20	25000 00	"	50c	600	77 00	Yes	76 00	Yes
Attalla, Ala	West'n & Nat'l	25	2000	Yes	"	1 65	10000 00	"	70c	150	80 00	No	.....	"
Aurora, Ill	G. El. Co. & W'n	162	2000	"	"	1 81	41800 00	No	.....	.....	58 44	Yes	326 92	"
Bay City, Mich	Ft. Wayne El. Co.	180	2000	No	Shavings	pr yr 1750 00	30000 00	"	.....	.....	46 00	"	100 00	"
Blufftown, Ind	T. & H.	85	2000	"	Natural Gas	100 00	10500 00	"	.....	.....	60 00	"	75 00	*...
Bloomington, Ill	T. & H.	220	2000	Yes	Coal	1 75	73000 00	....	.....	.....	50 00	"	111 00	Yes
Clarion, Iowa	Incandescent	....	.....	No	"	2 30	8000 00	Yes	*.....	700	.....	No	.....	"
Charlton, Iowa	.....	....	.....	"	"	1 20	22000 00	"	Aver. 50c	1200	.....	"	.....	*...
Chambersburg, Pa	T. & H.	72	2000	Yes	"	3 00	20000 00	No	.....	.....	78 00	"	.....	Yes
Coldwater, Mich	T. & H. and W'rn	70	2000	"	Oil	100 gal 1 72		Yes	.....	2800	less th'n 60 00	Yes	25c pr n't	"
Council Grove, Kas	T. & H. and W'rn	29	1200	"	"	3 60	8000 00	"	*.....	43	75 00	No	.....	"
Crawfordsville, Ind	W'rn Arc & N'l	141	2000	No	Natural Gas	2400 00	70000 00	"	40c	2100	25 50	Yes	71 42	"
Crete, Neb	T. & H.	50	1200	"	Water	100 incad.	8000 00	No	.....	.....	0	No	.....	"
Chehalis, Wash	Edison	30	2000	Yes	W'd & Saw'st	Wood 1 59	10000 00	Yes	*.....	440	8 00	"	.....	"
Dunkirk, N. Y	W'rn El. Co.	75	2000	"	.....	.....	.....	.....	.....	.....	41 43	.....	.....	"
Emmans, Pa	West'ghouse Alt.	12	2000	No	Coal	2 50	3000 00	No	.....	.....	48 00	No	.....	"
Easton, Pa	W'rn El. Co.	108	2000	"	"	2 85	30000 00	"	.....	.....	81 44	"	.....	"
Fairfield, Iowa	Brush	14	2000	Yes	"	2 30	6000 00	"	.....	.....	72 00	Yes	150 00	"
Fredonia, N. Y	Ft. Wayne	57	2000	No	"	2 15	13000 00	"	.....	.....	35 00	No	.....	"
Gainsville, Ga	T. & H.	50	1200	Yes	Wood	1 50	10000 00	Yes	*.....	35	.....	Yes	75 00	"
Galion, Ohio	Ft. W. Jenny	72	2000	No	Oil	16 10 pr gal.	30000 00	"	50c	850	65 00	No	.....	"
Grand Ledge, Mich	Jemez	15	.....	"	Coal	*.....	6000 00	No	60 00	.....	60 00	"	.....	"
Hannibal, Mo	Wood Arc	100	2000	"	"	2 00	20000 00	Yes	50 to 75c	2000	60 00	"	.....	"
Herrington, Kas	T. & H.	28	1200	Yes	"	2 00	29000 00	"	75c	620	0	Yes	100 00	"
Herkimer, N. Y	Edison	50	2000	"	"	2 68	14000 00	No	.....	.....	50 00	No	.....	"

High Point, N. C	Am. El. Co.	32	.....	No	Wood	2 00	6000 00	Yes	50 to 75c	100	.....	No	.....	Yes
Huntington, Ind	Ft. Wayne Jenny	....	2000	"	Gas	per yr 800 00	15000 00	No	.....	.....	55 00	"	.....	"
Jamestown, N. Y	Wood	137	1200	....	.....	.....	28000 00	....	.....	.....	43 92	....	.....	"
Leon, Iowa	Edison	....	.....	No	Coal	1 85	.....	Yes	*	500	*	.....	.....	*
Luverne, Minn	W'rn A & W'gh	40	2000	Yes	"	3 35	*	"	50c	455	.....	No	.....	Yes
Londonville, O	Wood	40	2000	No	"	2 50	18000 00	"	*	725	.....	"	.....	"
Little Rock, Ark	Ft. Wayne	136	2000	"	"	3 15	39700 00	No	.....	.....	69 83	"	.....	*
Lewistown, Me	Wood	100	2000	"	Water Power	.....	16000 00	"	.....	.....	43 00	Yes	109 00	Yes
Marietta, O	Wood & Indpls	110	2000	"	Coal	1 25	18000 00	"	.....	.....	60 00	No	.....	...
Montesano, Wash	Westinghouse	....	.....	"	Wood	2 25	6224 75	Yes	1 25	.....	.....	"	.....	Yes
Madison, N. J	T. & H. Alt.	30	.....	Yes	Coal	.....	20000 00	"	10	600	.....	"	.....	"
Marshalltown, Ia	" "	65	1200	"	"	1 25	12000 00	No	.....	.....	*	Yes	100 00	"
Madison, Ga	" "	40	2000	No	"	2 00	22000 00	Yes	*	175	80 00	No	.....	*
Madison, Ind	Jenny	86	2000	"	"	1 49	20000 00	No	.....	.....	62 00	"	.....	Yes
Marquette, Mich	Brush & Wst'ghs	100	2000	"	Water Power	.....	70000 00	Yes	*	2700	40 00	"	.....	"
Middletown, Pa	Wood, T. & H.	51	2000	"	Coal	1 95	25000 00	Yes	*	500	0	"	.....	"
Michigan City, Ind	Jenny	50	2000	Yes	"	.....	10000 00	No	.....	.....	.....	"	.....	*
Miamisburg, O	T. & H.	46	2000	No	"	1 75	12000 00	Yes	*	800	52 00	"	.....	*Ys
Martinsville, Ind	Ft.W J'y & B. Eng	30	2000	Yes	"	*	5000 00	No	.....	.....	33 00	"	.....	....
Metropolis, Ill	Ft. Wayne	30	2000	No	"	1 15	6000 00	Yes	*	300	.....	.....	.....	....
Oxford, O	Westinghouse	36	.....	....	.....	.....	23400 00	"	½c meter	1300	* 0	.....	.....	*
Peabody, Mass	Edison & T. & H.	....	1200	....	Coal	4 20	50000 00	*	.....	.....	91 35	.....	.....	*
Peru, Ill	Edison	....	.....	Yes	"	*	20000 00	Yes	60c to $1	650	.....	Yes	*	Yes
Painesville, O	Western	70	2000	No	"	2 10	12000 00	No	.....	.....	43 60	"	72 00	"
Paris, Ill	Ft. Wayne	90	2500	Yes	"	*	10000 00	"	.....	.....	23 00	No	.....	"
Rock Port, Mo	Edison	....	.....	"	"	2 90	6000 00	Yes	50, 60, 70 & 75c	* 406	*	"	.....	"
St. Charles, Ill	T. & H. and Ft. W	150	32c. p.	No	"	2 50	9000 00	....	.....	.....	* 12 00 in l'ts	.....	.....	"
Shelbine, Mo	Royal	*	.....	"	"	2 00	7000 00	Yes	10 L 50	310	.....	No	.....	....
Stuart, Iowa	Hawkeye	....	.....	"	"	1 75	15000 00	"	*	1300	.....	"	.....	Yes
St. Peter, Minn	T. & H.	45	2000	Yes	"	*	17000 00	"	50 to 65c	675	*	d't no	.....	"
St. Clairsville, O	Westinghouse	30	2000	No	"	.....	10000 00	"	*	400	33 65	No	.....	"
So. Norwalk, Conn	Western	90	2000	"	"	3 75	*22500 00	*	.....	.....	.....	Yes	*	....
Shelby, O	T. & H.	44	2000	"	"	*	19600 00	Yes	30 to 55c	725	56 00	No	.....	....
Schuyler, Neb	Edison	10	2000	Yes	"	25	7500 00	"	40 to 50c	600	.....	"	.....	Yes
Savannah, Mo	T. & H.	25	1200	No	"	1 00	12000 00	"	35 to 50c	450	* 72 00	.....	.....	"
Santa Cruz, Col	Brush	74	1200	Yes	Wood	3 50	.....	No	.....	.....	50 00	No	.....	"
Tecumseh, Neb	Edison	....	.....	"	Coal	2 15	5000 00	Yes	*	485	.....	.....	.....	"
Tipton, Ia	Brush, Edison	4	2000	"	"	3 35	.....	"	50c	200	75 00	Yes	166 66	No
Webster City, Ia	Mathes	....	.....	"	"	1 65	24000 00	"	*	2100	.....	No	.....	Yes
Wilton Junction, Ia	Edison	....	.....	"	"	2 15	7000 00	"	35c	450	.....	"	.....	"
West Troy, N. Y	Edison, Ball	90	.....	No	"	3 00	22000 00	No	.....	.....	60 00	Yes	70 00	"
Wheeling, W. Va	Wood	400	2000	Yes	"	.04⅓ pr bu.	100000 00	"	.....	.....	50 00	No	.....	"
Wytheville, Va	Edison & Sperry	25	1200	No	"	2 75	.....	Yes	*	300	.....	"	.....	"

tached to this report in the form of a table, that by reference to it information may be quickly and easily obtained.

"We find that Albany, Mo., Crete, Neb., Herrington, Kan., Middletown, Pa., and Oxford, O., have municipal plants, and from the profits derived from the commercial arc and incandescent lights furnished by them are able to pay all of the expenses of the plants and furnish the street lights without cost to their taxpayers, which is certainly a splendid showing.

"We find the prices in other citied varies from seven dollars for each arc street lamp per year all the way up to and more than is paid in this city, but at the same time we find the price varies nearly in proportion to the price of fuel in those cities, and as coal for our water-works is furnished at about one dollar and ten cents per ton, we believe that we are favorably situated to get cheap and efficient lighting service.

"The street arc lights for this city cost $67.50 per lamp per year, and we now have 237 of them, and at this price—which is considered very low for a private corporation to furnish—amounts to $15,997.50, and, in addition to these, there are 389 vapor lights costing $14 each per year, or nearly $5,446, which, added to the cost of the arc lights, makes a total of $21,443.50, or about one-sixth of the whole amount received from taxes for municipal purposes that is paid for street lighting alone. * * *

"When this city owns and operates an incandescent plant with the arc light plant, it would, as other cities do, derive profit enough to nearly, if not entirely, pay for the cost of running such an institution, as well as the interest on the necessary bonds for its purchase or erection, and get the street lights for little or nothing.

"One thing is certain, there would be no combination or tacit understanding between the city and the gas company as to who should occupy this or that street, and the price and quality of gas would be more satisfactorily regulated by competition than all of the legislation that could be made would accomplish. We believe that the city should issue its bonds for this purpose, and the control of these plants should be placed in the hands of the water-works trustees.

"We, therefore, recommend that the necessary steps be taken to procure legislation enabling this city to issue its bonds in an amount

not exceeding $100,000, at not more than 6 per cent. interest, for the purpose of erecting or purchasing, owning and operating an arc and incandescent electric lighting plant for street and commercial purposes."

The council decided to submit question to a vote of the people.

Mayor Pingree, of Detroit, is an advocate of municipal ownership of street lighting, and has had three estimates on the cost and operation of a plant in that city prepared for the consideration of the Detroit Council. The estimates are as follows:

Estimate No. 1.—For 2,000 arc light plant, complete, with fireproof building, direct coupled engines and dynamos:

Real estate and building	$35,800 00
Boilers and appurtenances	44,000 00
Engines and connections	58,000 00
Dynamos and station electrical appliances	70,000 00
Contingent, 5 per cent	10,090 00
Total cost of station	$217,890 00
Lamps, lines, etc.:	
Distributing converters	$30,000 00
2,000 arc lamps	60,000 00
2,000 iron poles or mast arms, complete, at $20	40,000 00
500 miles of pole line, $200 per mile	100,000 00
20 miles of conduit system, including copper wire, complete	80,000 00
Contingencies	10,000 00
	$320,000 00
Total investment	$537,890 00

Cost of operation and maintenance per year, station to run 12 hours per day, at 2,000 horse power:

Office expenses	$6,000 00
Power plant employes	11,540 00
Fuel and maintenance	24,090 00
Repairs, and depreciation of power plant, at 5 per cent. on $172,800	8,640 00
On building, at 2½ per cent	600 00
Oil, waste and supplies	3,000 00
Interest on station and power plant, 4 per cent. on $201,800	8,072 00
	$61,942 00
Cost per horse power per year delivered to line	27 97

Cost of maintaining lamps and lines per year, 2,000 lights:

Trimmers, repairers and underground conduit men, 35; at $2 per day	$25,550 00
2,000 pairs of carbons, per day	14,600 00
Repairs and depreciation on lamps, lines and converters, at 3 per cent	6,900 00
Repairs and depreciation on conduit system, at 3 per cent	2,400 00
Interest on lines, lamps, conduit system, etc., at 4 per cent	12,800 00
	$62,250 00
Cost per lamp per year for line and lamp maintenance	31 12
Total cost per year	124,174 00

Total cost per lamp per year:

Expense of commissioners' office per lamp per year	$3 00
Cost of power delivered to line per year	27 97
Cost of lamp and line maintenance per year	31 12
	$62 09

Estimate No. 2.—

Cost of plant, as per Estimate No. 1 ..... $537,890 00

Cost of operation and maintenance per year, based on moonlight schedule of 1893; calculated on plant to start one half hour after sunset and one hour before moonset, and to stop one hour after moonrise and one hour before sunrise.

Hours of station operation:

	H.	M.		H.	M.
January	206	10	July	152	00
February	193	40	August	164	20
March	175	40	September	180	20
April	153	50	October	212	10
May	144	10	November	219	00
June	137	50	December	244	20
				2,183	30

Total cost per year:

Expense of commissioner's office	$6,000 00
Cost of power	42,627 00
Cost of lamps and line maintenance	54,930 00
	$103,557 00

Total cost per lamp per year:

Expense of commissioner's office	$3 00
Cost of power per lamp per year	21 31
Cost of lamp and line maintenance	27 46
	$51 77

A saving of $20,640 per year in cost of operation over Estimate No. 1.

Estimate No. 3.—

For 2,000 arc light plant complete, with fireproof building, engines, driving countershaft, belted dynamos:

Real estate and buildings	$45,000 00
Boilers and appurtenances	72,000 00
Dynamos and station electrical appliances	65,000 00
Contingent	11,400 00
Poles, lines, etc	47,000 00
Total cost of station	$240,400 00
Lamps, lines, etc	300,000 00
Cost of operation and maintenance per year, station to run 12 hours per day	66,255 00
Cost of horse power per year delivered to line	33 12
Cost of maintaining lamps and lines	60,450 00
Cost per lamp per year	30 22
Total cost per year:	
Expense of commissioner's office, per year	$6,000 00
Cost of 2,000 horse power per year	66,255 00
Cost of maintaining lamps and lines, per year	60,450 00
	$132,705 00
Cost per lamp per year	66 33

Operated under the moonlight schedule, as per estimate No. 2, the cost of maintenance per lamp per year will be $56.

A CITY ENGINEER'S VIEWS ON MODERN STREET PAVING.

[MR. NILES MERIWETHER, city engineer of Memphis, Tenn., in his recent annual report concisely makes some valuable suggestions on street paving, which are given below.]

As regards the best material for street paving, and the best methods of construction, a great deal may be said.

A great deal depends upon the location, soil, gradients and drainage, conditions and requirements, as well as upon climatic conditions, no two places being, in all respects, alike. Again, the amount and character of traffic, and its proper regulation, enter as prime factors into the consideration of any paving material. There are so many various conditions that it is quite impossible to make any fixed rule which shall be of general application. That which may be

within reach and means of one place may be wholly beyond that of another, hence, in the consideration of this question, the opinions of engineers and others are often greatly at variance. Nearly all, however, agree that no durable or satisfactory pavement can be made or maintained for any great length of time, unless founded on a good concrete base, whether the wearing surface be of granite, asphalt, brick, wood, or any other paving material, the amount and character of traffic being considered.

The sheet asphalt comes nearer being the ideal pavement for all conditions and uses. It must, however, be properly constructed and be of the very best material and have constant attention. As now constructed by skilled and experienced hands under scientific methods, it is the most beautiful pavement laid and withstands an enormous amount of vehicular traffic.

Many fine examples of the best modern construction are now to be seen in a number of places, notably in New York City and in Philadelphia.

But this pavement, more than either granite or brick, is affected injuriously by dirt and moisture, and requires to be kept as clean and dry as possible. It is sometimes injured by gas escaping from leaky mains beneath. It is, however, easily repaired and cleaned, and if properly cared for, in a timely way, after prescribed methods, it is one of the most satisfactory pavements that can be laid.

The modern brick pavement, built in accordance with the best practice, on moderate grades, makes a superior pavement, and is destined to come into general use, especially in the smaller cities, where the traffic is not excessive, on account of the difference in cost as compared with granite and asphalt.

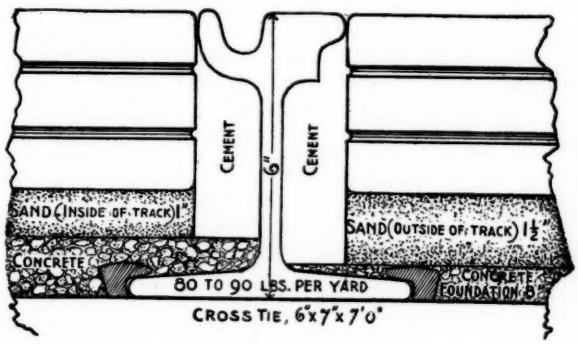
With an extended experience in burning, and otherwise perfecting brick for paving purposes, much greater durability, under increased traffic, may be looked for.

While it can not now be said that brick will withstand, for the same time, the heavy traffic carried by either granite or asphalt, yet it has, in many respects, the essential qualities for a superior pavement. It is nearly impervious to moisture; it is quite noiseless; it affords good footholds and offers little resistance to traction; it is adapted to grades of two or three feet per hundred or more; it is easily cleaned, and is not greatly affected by water and dirt, or by

acids; it can be rapidly and cheaply laid, and readily repaired or renewed at moderate cost, and under moderate traffic (fifty to sixty tons per foot of wheelway) will last eight or ten years without repairs.

On all streets upon which street-car lines are located, owing to the number of breaks in pavement surface, it is advisable to lay the brick at right angles to the line of street, except at street intersections, where they should be laid at an angle. On all other streets, wherever used, they should be laid at an angle of forty-five degrees. This method, it is believed, will prolong the life of the pavement several years.

Where the traffic of a street is heavy and continuous, and when cost and noise are secondary, the durability with least repairs is a



prime consideration, all authorities agree that a first-class granite block pavement stands first. Such pavements are now laid at from forty to forty-five cents per square foot on eight to nine inches concrete foundation, and when properly laid will sustain a traffic of two hundred tons per foot of wheelway per day, with moderate repairs, for fifteen or more years.

Telford and macadam pavements, on account of the low price (in first cost) at which they can be built, as compared with granite, asphalt, brick and wood pavements, will continue to make up the principal mileage of street pavements in most cities. When constructed after approved specifications and with good material, excellent pavements can be made; but, as traffic increases, the expense for maintenance grows apace and with great rapidity.

In making repairs, filling holes and ruts and resurfacing, the

tendency is to excessive crowning of street, which can only be avoided by picking over and redressing of surface before adding new material, all of which increases cost of maintenance in this form of pavement over that of others named. But notwithstanding the first cost being so much below that of the other, it will continue to be extensively laid, especially in the smaller cities and towns where the means for building pavements are limited.

Just here we may properly ask of what use is it to build good streets at great cost (no matter of what material) if they are to be destroyed in a few years by the continued use of the present narrow wheel tires? It would be hard to conceive of a more destructive vehicle on streets, as well as on animals, as that of the dray with its rough, springless body and dead weight, mounted on two wheels, having but two and three-quarter inch width of tires. With such an instrument of destruction it is useless to expect any street to withstand, for any great length of time, its destructive effects combined with that of the elements.

There is room for reform and great improvement in this respect. The width of all wheel tires, more especially those for trucking purposes, should be regulated in accordance with the loading or carrying capacity, distribution of load and build of vehicles, giving preference to those with springs, or to express it differently, each square inch of wheel tire should have a fixed limit of load to carry per square inch of bearing surface per wheel, including weight of vehicle. To illustrate, take the common two-wheel dray, having about 2¾-inch tires, weighing say 750 pounds, loaded with six bales of cotton and driver, say 3,100 pounds, and we have a total of 3,850 pounds, or 700 pounds per square inch of wheel tire, dead weight; put this in rapid motion and it means death and destruction to all around.

In the interest of commerce, progress and general advancement of economy, humanity and individual comfort, the subject is worthy of study and of serious consideration by the citizens of every municipality.

Statistics and proofs relating to all these matters are constantly being compiled by able and experienced engineers and builders of roadways, streets and other municipal works, and they are everywhere in reach of anyone who may be interested in the subject.

Niles Meriwether.

THE SEWERAGE SYSTEM OF MEMPHIS.

[THE review of the Memphis system of sewerage, embracing suggestions as to how it may be improved and protected, was recently submitted to the common council of that city, as given below, by Mr. George E. Waring, Jr., the engineer who had charge of the work.]

So long a time has elapsed since the present system of sewerage was begun that it may not be amiss to recall its history. My first connection with the subject was late in 1879, when I came to Memphis as an engineer of a committee of the national board of health, which was charged with the recommendation of sanitary improvements, intended to prevent a recurrence of the epidemics of yellow fever, which had for two successive years devastated the town, ruined its prosperity and greatly reduced its population.

Those who have known Memphis only after the regeneration that followed that period can form little idea of the sad plight in which this great disaster had left it. Its sanitary condition had never been good, and when the people began to return to their homes after the exodus of the second fever year, it was as bad as it could be. The spirit of the leading men of the city at that time was, however, most admirable. They determined that whatever the board of health committee should advise must be carried out, and that the stricken town should be again put upon its feet, and should start right for its renewed strength. They foresaw the advance that was possible, and they determined to pave the way for it.

The splendid modern city of to-day is a monument to their manly and resolute effort, the full value of which can be appreciated only by the few who know the woeful condition from which they have raised it. It was decided that the first work of improvement should be the construction of a system of sewerage. But sewerage was very costly, and the community was very poor. Some years before a plan of sewerage had been made, which would cost enormously more than it was possible to pay; there was no method of city sewerage then in vogue by which what was determined to be immediately necessary could be constructed for less than $500,000. Less than one-half of this amount was available.

I had recommended a theoretical system which had never been

put into execution—which probably never would have been put into execution but for the great needs and the great poverty of Memphis.

This system consisted of small earthenware pipes, carrying foul sewerage only, from which all rain water was excluded, and in which the occasional, irregular and unreliable flushing during rains, was to be replaced by the daily discharge of automatic flush tanks at the heads of all the branches of the sewers. It commended itself to all the health authorities and to the leading citizens, and its adoption was urged by the council.

Many a hard battle had to be fought against ignorance, timidity and stupidity before the order for its construction was finally given. I made three separate visits to argue in its favor, twice before the council and once before a large meeting of citizens at the Cotton Exchange, where it was, after a long and hot discussion, accepted by an acclamation, against which only one single "no" was raised.

The discussion concerning details was long protracted. In the course of this it was determined that in view of the defective water supply from Wolf river, which was then in use, it would be an ample allowance to provide for a water consumption of 40 gallons per person per day, or 2,000,000 gallons for a population of 20,000. The actual daily consumption, at the present time, is more than 6,000,000 gallons. My original estimate provided for a full supply of man-holes, costing, as I remember, about $15,000. It was decided that we could get along with some cheaper substitute, and that if man-holes were found to be necessary in future, the richer future city could afford to build them. So the man-holes were omitted. For a like reason, the main sewers were confined to a size barely sufficient for 2,000,000 gallons capacity. I remember that Dr. Porter argued before the council that it was a great advantage of the system that it could be built with main sewers adapted to present needs, and that supplemental mains could be laid when they were needed, and when the city could better afford to build them. At last, the order was given, and ground was broken on the 21st of January, 1880. I collected together a party of 18 assistant engineers, from various parts of the country, only two or three of whom had ever done any sewer work, and none of whom had ever seen such sewers as we built here. Men, materials and tools were collected in great haste, and a rush was made to put in as much sew-

erage as possible before June 1, which the board of health fixed, as the latest time at which it would be possible to stir up the polluted soil without danger. We worked for about twenty weeks, fully five weeks of which time was lost by bad weather, generally heavy rains. This rainy weather was so distributed that the ground was in a very bad condition nearly all the time.

During fifteen weeks of actual working time, in spite of innumerable difficulties, we invented our processes, organized our forces, procured our supplies, and built more than eighteen miles of sewers, including the brick main from the jail to Jackson street, and the two main sewers east and west of Bayou Gayoso; we did this at a cost, including the engineering and superintendence, of less than $140,000.

If time has shown that something less than absolute perfection was secured, here and there, I think it may still be said that, considering all the circumstances, we did reasonably well.

The work then done had its desired effect of aiding to improve the sanitary condition of Memphis, and of showing to the world that this condemned city had taken on a new life, that it was earnest in its determination to overcome the disastrous effects of its epidemics, and that it offered a hopeful field for enterprise. During the 13 years that have since passed, it has maintained its promise, and from that moment of its regeneration it has gone bravely on and has by its prosperity astonished the world, which in 1879 would have been glad to see it swept off the face of the earth, as a dangerous public nuisance.

The work then done has had another effect—it has revolutionized the methods of sewering the smaller towns. Not only have the principles first set forth here in 1880 been adhered to in the construction of the 32 miles of additional sewers built in Memphis, but the same system has been adopted in all parts of the country, until it is safe to say that, in work executed and now in hand, the total length of similar sewers is not less than 1,000 miles.

It has attracted attention and has found some imitators in other countries, and the name of Memphis is known, because of its sewers, in some quarters to which its fame would not otherwise have penetrated.

Naturally, as with all new processes, modifications have been made in the arrangement, construction and maintenance of this sys-

tem, but these modifications have generally been improvements, but in its essential feature the system remains the same to-day that it was when first adopted here in 1879.

These features are:

1. The use of pipes so small that the stream sent through them will flush them sufficiently.

2. The exclusion of storm water.

3. The substitution of regular automatic flushing for rain or hand flushing.

These features will, in my judgment, come more and more into favor as times goes on.

This is the system that you have in use in Memphis, crude in some regards, as it was learning its first paces at the hands of inexperienced men a dozen years ago along the slopes of Bayou Gayoso, and doubtless more complete and workmanlike as the experienced engineers of the city have constructed it in other portions. On the whole, I think we all have good reason to be satisfied with it.

I have been invited to make a careful inspection of the sewers in their present state, and to make such recommendations concerning them as seemed to be proper. To this end I have gone carefully over the work with President Clapp, Maj. Meriwether and Mr. Elliott, and I have been given the fullest opportunity to see all that I desired to see, and the fullest and frankest information has been cordially furnished me. I find that there are now in service 50½ miles of sewers of the system under consideration. There are, in connection with the system 253 flush tanks and 478 man-holes; there are about 7,000 house connections. The house connections receive the wastes of the following fixtures: Water-closets, 9,672; slop sinks and catch basins, 6,920: bath tubs, 1,149; waste basins, 840; urinals, 666; laundry tubs, 194; latrines, 12.

It is said in a general way that the lateral sewers of the system have ample capacity for their work. It is reported that they never run half full, and that they rarely run one-third full. The brick sewer runs about half full, and the east and west mains run less than full, when they are not gorged with water from rains and when they are clean. Some years ago the east and west mains were intercepted at Monroe street by a sewer running from that street to

the river; but for this interception the mains north of Monroe street would now be overtaxed most of the time.

In one respect these sewers are called upon for a duty they are not intended to perform—that is the removal of a large amount of storm water. In spite of the most careful, proper and sufficient regulations, with sufficient penalties provided for by the ordinance passed in 1880, the plumbing and drain-laying work on private property was for years allowed to take care of itself. Any kind of plumbing and any kind of drain-laying, for which the most penurious owner employed the most incompetent mechanic, was allowed to be done by the utterly neglectful sewer department.

The property-owners of Memphis must, now or later, repay, with heavy interest, the amounts saved by their former parsimony in this matter.

The sewerage system will never be satisfactory until these gross defects are remedied. I am glad to see that under the present administration the president of the city and the engineering department are upholding Mr. Lunn in his efforts to secure an absolute compliance with the rules and regulations established concerning the methods of house plumbing, and of connecting private premises with the public sewer. Success in this direction means success to the whole system of sanitary drainage, and the establishment of health conditions, which have always been aimed at, but which have heretofore not been fully secured.

In addition to the bad sanitary conditions sure to follow neglect in this matter, especially in the case of the poorer tenements—and these are the usual starting points of epidemics—the injury to the sewer system has been most serious. Aside from the obstructions to the proper flow of the sewers, of which Memphis has had an unprecedented crop, there has also resulted, from careless work on private property, a great inflow of storm-water, during and after every heavy rain. In some cases there is leakage about the fixtures, especially about and over the tops of yard catch-basins. In others, rain-water leaders have been willfully discharged into the catch-basins; and in very many more cases the connecting drain in the ground, leading from the fixtures to the public sewer connections, is laid with leaky joints, so that it acts as an underdrain and carries to the sewers the water saturating the ground after rains. I

judge that the amount of water thus introduced into the sewers within two or three days after a heavy rain amounts to at least four or five times as much as the flow of sewerage proper passing within the same period.

This extraneous inflow should be stopped, at any necessary cost. In the matter of obstructions due to the former neglect of proper control above referred to, Memphis leads the world; there are more stoppages here, per mile of sewerage, in one week, than occurs in towns where the system is properly guarded, in a whole year.

For example, Stamford, Conn., has about 12 miles of six-inch sewers, which have been in use for about six years. It is a flat town, and most of the sewers are laid on a slight inclination. The warden told me last month that they never had a single stoppage in the sewers, and only three in the house drains, due to the gross carelessness of the users. The house drains of Memphis may be, and should be, made so good as to produce the same result here. The man-holes and inspection pipes of Stamford have never been opened except from curiosity; not one of them has ever been used since the work was finished, and this is the experience of many other towns having this system of sewerage.

So far as the sewers themselves are concerned, in Memphis, their chief defect seems to me to be that they are not adequately flushed. The flush tanks discharge from 110 to 130 gallons, and the discharge occupies probably from 45 to 75 seconds. This was originally supposed to be sufficient, but experience here, as well as elsewhere, has shown that it is not so. The whole discharge should be as much as 150 gallons, and it should be shot into the sewer in 20 seconds or less. The siphon available when this work was done was not quick enough in its action, but we have a siphon now in use which will discharge 150 gallons in from 13 to 15 seconds.

Under the conditions now existing in Memphis, the lateral sewers accumulate deposits, and these deposits foster the growth of a troublesome fungus; this fungus and the deposits accumulate during dry weather. When a heavy rain falls, enough of its water runs into the laterals to wash much of this accumulation into the main sewers, where the man-holes help to prevent its immediate and complete removal. The mains are then gorged, sometimes to overflowing, until by repeatedly passing the wire brush through the pipes,

the obstructions are cleaned out. The sub-mains and laterals are then brushed, and the system works properly, until another period of accumulation. So long as the sewers receive the intelligent and careful attention now bestowed on them they will continue to perform their work as they now perform it.

Something, much better than this, however, is needed to constitute such a perfect sanitary system of sewerage as Memphis should have. The sewers should keep themselves clean; they should not be dependent upon intelligent care. While they remain thus dependent, however, a larger force of workmen should be at the disposal of the engineer having charge of them. The present small force is not able to do the work properly.

1. More efficient flushing should be provided. The present tanks discharge into the sewers an average of about 120 gallons in about 50 seconds, or at the rate of 2 4-10 gallons per second. Tanks should be constructed which would deliver 150 gallons in 20 seconds, or at the rate of 7½ gallons per second. One hundred and fifty gallons would fill about 115 feet of 6-inch sewer, entirely full, and such a discharge would have a scouring effect very materially greater than that of the present flush. This, when delivered with such rapidity, would, in conjunction with an occasional ball cleaning, keep the sewers in better condition than it is possible to secure by manual labor. The renewal of the tanks would not cost more than about $10,000. Aside from the much needed improvement they would effect, they would save an annual outlay of over $2,000, or the interest at 5 per cent. on $40,000. They would maintain the sewers in a state of cleanliness that could not be approached by any practical brushing by hand. I think this the most important improvement to be made.

2. Openings should be made in the sewer connections near the property line, with suitable movable covers, and with the aid of these openings the flow of water during and after rains should be so examined as to determine the amount of actual rainfall, and if underground drainage flowing to the sewers from any given private premises. Strenuous measures should be taken to prevent such flow by requiring property owners to provide other means for the discharge of rain water. The sewers are not intended for such use,

and they can not be so used, without interfering with their efficiency for their legitimate service.

3. Obstructions should, wherever possible, be traced to their origin, and the plumbing fixtures and slop sinks of offending parties should be so arranged as to prevent a further admission of articles large enough to cause obstructions in the public sewers.

4. With all their advantages, man-holes have, in some cases, drawbacks that it would be well to remedy. Especially in the east main, and to a less degree in the west main. The sewage in time of excessive flow rises in the man-holes considerably higher than the sewer, and a pool of sewage rises and stands in them. Floating filth rises to the surface of each pool and makes the man-holes very foul. As the flow recedes this filth is carried into the sewer in masses which may accumulate and obstruct the flow. In cases where this is likely to happen—in all cases, that is, where the flow rises above the benches of the man-holes—the channels through which the sewers pass should be covered with iron plates laid on the benches to keep the solids within the course of the moving current, so that they would be carried to the outlet. Such places, properly supplied with lifting staples, could be conveniently handled.

It is hardly necessary for me to say, that, however good a system of sewers may be, they can not be trusted without help or supervision to keep themselves clean, neither can they be expected to cope with the carelessness and heedlessness of those who use them. This difficulty can be properly met, only by the supervision of an intelligent engineer, armed with authority to enforce rules, and controlling a sufficient force to maintain good conditions.

George E. Waring, Jr., Consulting Engineer.

ASPHALTUM IN THE UNITED STATES.

[From the Eighth Report of the Mineral Resources of the United States, just issued, by J. W. Powell, director of the United States Geological Survey.]

THE total output of bituminous rock in California in 1891 was 39,962 short tons, worth at the point of production, exclusive of cost of transportation, $154,164. Kentucky produced 3,360 tons of bituminous rock, worth $2 per ton at the mines. The amount of

gilsonite and bituminous limestone from Utah was 1,732 short tons, worth $82,100. It has been customary to give the value of gilsonite at St. Louis, to which city the product is shipped for sale and manufacture. This custom has been adhered to in this report. The bituminous limestone was sold in Salt Lake City, and the value of this portion of the product has been taken at its selling price in that city. We have then, as the total value of the asphaltum products in 1891, $242,264, an increase of $51,848 over the value of the product in 1890.

The bituminous rocks of California and Kentucky do not materially differ. It is in each case a sandstone impregnated with bitumen, the value being determined by the amount of pure bitumen contained. This product is used principally for street paving, for which comparatively little preparation is necessary.

Considerable attention is being paid to the bituminous sandstones of California. Several of the mining companies have pooled their interests, looking to the development of the best of the many properties, to the further introduction of the material in the arts and manufactures, and maintaining the industry upon a profitable and satisfactory basis.

The consumption of California bituminous rock must, however, remain restricted to a practically local community until such arrangements can be made with transportation companies as will admit of its being brought into competition with Trinidad and other foreign asphaltum in the Eastern market. The condition of the Kentucky product is as yet undetermined, the product for 1891 having been experimentally used for street paving. If proved satisfactory it will probably find a good market in Louisville, Cincinnati and adjacent cities. The California rock is used largely in San Francisco, Oakland, Los Angeles, etc., but owing to difficulty and expense of transportation reaches no market distant from the coast.

The form of asphaltum which has been styled "lithocarbon," and said to be found in great quantities on the line of the Southern Pacific Railroad in Texas, is still a matter of technical interest, as press notices from time to time indicate. It has not been shown, however, that any active steps are being taken to develop the property and place the mineral on the market. If all that is claimed

for it be true there should be small delay in getting it before the country.

The following table shows the annual product of asphaltum and bituminous rock since 1882:

PRODUCTION OF ASPHALTUM AND BITUMINOUS ROCK SINCE 1882.

Years.	Short tons.	Value.
1882	3,000	$10,500
1883	3,000	10,500
1884	3,000	10,500
1885	3,000	10,500
1886	3,500	14,000
1887	4,000	16,000
1888	50,450	187,500
1889	51,735	171,537
1890	40,841	190,416
1891	45,054	242,264

The amount of asphaltum imported continues to be largely in excess of the domestic production. The island of Trinidad furnishes the greater portion of the supply, 71,112 tons of the 102,433 tons imported during 1891 being from that source. The remainder of the imports are made up of bituminous limestone from Sicily, Germany, Switzerland and France, and a small amount of asphaltum from Cuba.

ASPHALTUM IMPORTED INTO THE UNITED STATES FROM 1867 TO 1890.

Years ended—	Quantity.	Value.	Years ended—	Quantity.	Value.
	Short tons.			Short tons.	
June 30, 1867	.....	$6,268	June 30, 1880	11,830	$87,889
1868	185	5,632	1881	12,883	95,410
1869	203	10,559	1882	15,015	102,698
1870	488	13,072	1883	33,116	149,999
1871	1,301	14,760	1884	36,078	145,571
1872	1,474	35,533	Dec. 31, 1885	18,407	88,087
1873	2,314	38,298	1886	32,565	108,528
1874	1,183	17,710	1887	30,808	95,735
1875	1,171	26,006	1888	36,494	84,045
1876	807	23,818	1889	61,952	138,163
1877	4,532	36,550	1890	73,861	223,368
1878	5,476	35,932	1891	102,433	299,350
1879	8,084	39,635			

As stated above, 71,112 tons of the asphaltum imported in 1891

were from Trinidad. The most of this was used for street paving, the number of square yards of Trinidad asphaltum laid during the year by all companies being 2,141,049, an increase of nearly 300,000 square yards over 1890, when the amount of paving laid was 1,857,000 square yards. To further illustrate the growth of this industry the following tables, showing the total amount of Trinidad asphaltum imported and the number of square yards of paving laid annually since 1880, are given:

IMPORTS OF TRINIDAD ASPHALTUM BY ALL COMPANIES FROM 1880 TO 1891, INCLUSIVE.

Years.	Long tons.	Years.	Long tons.
1880	3,913	1887	26,503
1881	6,707	1888	35,137
1882	14,263	1889	52,881
1883	23,309	1890	54,692
1884	19,630	1891	71,112
1885	15,289		
1886	27,757	Total	351,283

The number of square yards of Trinidad asphaltum laid in the United States in the past eleven years is as follows:

NUMBER OF SQUARE YARDS OF TRINIDAD ASPHALT PAVING LAID IN THE UNITED STATES FROM 1880 TO 1891, INCLUSIVE.

Years.	Square Yards.	Years.	Square Yards.
1880	106,838	1887	799,335
1881	116,629	1888	757,101
1882	196,184	1889	1,130,863
1883	387,510	1890	1,857,000
1884	424,524	1891	2,141,049
1885	403,882		
1886	623,188	Total	a8,944,103

a Equivalent to 586 miles of roadway 26 feet wide.

Trinidad asphaltum is being used for street paving in the fifty-nine cities in the United States and Canada named in the following list:

CITIES WHERE TRINIDAD ASPHALT PAVEMENTS ARE USED.

Washington and Georgetown, District of Columbia.
Denver, Colorado.
Savannah, Georgia.
Chicago, Cicero, and Peoria, Illinois.
Fort Wayne and Indianapolis, Indiana.
Topeka, Wichita, and Wyandotte, Kansas.
Covington, Louisville, and Newport, Kentucky.
New Orleans, Louisiana.
Baltimore, Maryland.
Boston, Massachusetts.
Detroit and Grand Rapids, Michigan.
Minneapolis and St. Paul, Minnesota.
Kansas City, St. Joseph, and St. Louis, Missouri.
Omaha, Nebraska.
Long Branch and Newark, New Jersey.
Albany, Amsterdam, Binghamton, Brooklyn, Buffalo, Dunkirk, Lockport, Long Island City, New York, Rochester, Schenectady, Syracuse, Troy, and Utica, New York.
Cincinnati, Cleveland, Columbus, Toledo, and Youngstown, Ohio.
Allegheny, Altoona, Erie, Harrisburg, Philadelphia, Pittsburg, Scranton, and Wilkesbarre, Pennsylvania.
Newport, Rhode Island.
Chattanooga, Tennessee.
Montreal and Toronto, Canada,

In eleven of the above cities the Trinidad asphalt paving was laid for the first time in 1891. These cities were: Denver, Colorado; Cicero and Peoria, Illinois; Covington and Newport, Kentucky; Grand Rapids, Michigan; Minneapolis, Minnesota; Long Branch, New Jersey; Amsterdam and Dunkirk, New York, and Newport, Rhode Island.

Mr. C. S. Chamberlin, secretary of the Sicilian Asphalt Paving Company, of New York, reports that his company imported into the United States during 1891 5,000 tons of crude bituminous limestone from Sicily and 1,500 tons from Germany, and estimates that the amount of bituminous limestone imported by other parties was about 500 tons.

The following pavements made from a mixture of Sicilian and German bituminous rock have been laid up to the close of 1891:

	Square yards.
1886 to 1891, at Rochester, New York	58,390
1886 to 1889, at St. Augustine, Florida	30,000
1889 to 1891, at New York, New York	84,599
1890, at Allegheny, Pennsylvania	6,041
1891, at Philadelphia, Pennsylvania	1,576

Of these there were laid in 1891 at Rochester, New York, 10,000 square yards; in New York city, 49,335 square yards, and in Philadelphia 1,576 square yards, a total of 60,911 square yards.

E. W. Parker.

CURRENT INFORMATION.

REMARKABLE SALE OF A STREET RAILWAY FRANCHISE.

In some respects the most remarkable offer for a street railway franchise ever received by any city in the United States has just been submitted to the municipal authorities of Indianapolis, and has been accepted by them.

In anticipation of the expiration of the charter of the company at present operating the street railway system of the city, known as the Citizens' Street Railway Company, there has been much agitation during the last three years as to what position the municipality should take with reference to a new franchise. Some have advocated municipal ownership of the plant and the leasing of it to an operating company; others have strongly favored the sale of the franchise, framed so as to require all desired service on the best terms that could be secured. The latter course was adopted by the board of public works, and it proceeded to prepare the kind of a franchise it was willing to sell, and announced that it would be disposed of to the highest bidder on April 19th. The company at present operating the system has maintained, however, that its charter does not expire until 1901, claiming that an extension of seven years had been given by a resolution of the common council in 1883. More recently it has intimated that it believed its charter to be perpetual. As the proposed new charter was much more favorable to the city than the old one, the present company, believing evidently that there would be no offer for the franchise, refused to bid. Unexpectedly to the public, on the day for opening bids a proposal was submitted by an unknown company which has since become somewhat famous as "the Great Unknown," and deposited $25,000 in cash as a guarantee of the fulfillment of its bid.

The proposal was far more liberal than had been expected. The board of public works had stipulated in the franchise that the minimum of gross earnings to be paid the city should be 2½ per cent. for the first five years, 5 per cent. for the second five years, 6 per cent. for the third five years and 7 per cent. for the remainder of the time. The offer of the company was ten per cent. per annum for the first five years, 12½ per cent. for the second five years, 13½ per cent. for the third five years, and 14½ per cent. for the remainder of the time, thus giving the city increasingly a liberal share in the earnings as the city grows in population. It is estimated that the bid will be equivalent to the payment of $11,000,000 for the franchise. Some idea of the increase in value of the franchise, due to the rapid growth of the city, may be gathered from the fact that five years ago the street railway was bought for $1,080,000, and last year was sold for $3,250,000, and efforts are now being made by the present company to negotiate bonds for $9,000,000 on a showing of earnings sufficient to warrant it.

The result has been so very satisfactory that the course of the Indianapolis Board of Public Works will undoubtedly become an example for other cities in the United States.

The proposed charter comprises twenty-nine sections. The first and second state that the agreement is to be made by the city through the board of public works as the party of the first part and —— as the party of the second part, and gives the authority for the making of such an agreement. Section 3 names the streets upon which tracks are to be laid and maintained. They are the same as those now occupied by the Citizens' Street Railroad Company. Section 4 stipulates that the contracting company shall not have the right to build lines on any other streets than those named until permission has been obtained from the board and city council, except that the right to build a line from Washington street to the city limits north and south will be granted; and provided, also, that the company shall discontinue any of the specified lines when agreed to by the board and council and the company.

Sections 5 and 6 limit the period of the grant to thirty years from 1893, and provide for the payment to the comptroller, quarterly, the following minimum per cents.: First five years, 10 per cent. on gross receipts; next five years, 12½ per cent.; next five years 13½ per cent., and for the remaining term of the contract, 14½ per cent. This shall be in addition to city taxes. Section 7 requires a register in each car, the keeping of an accurate statement, showing the number of trips made and the amount of fare collected, a monthly statement and exhibit of books, and the appointment of a committee of three by the mayor to examine such report.

Section 8 provides that a single cash fare shall not exceed 5 cents, which shall entitle the passenger to all transfer privileges; that six tickets shall be sold for 25 cents, and that children three years old and under shall be carried free when in care of a proper guardian. Section 9 requires the maintenance of a transfer system by means of tickets, furnished to passengers by conductors, good on any line of the company within the city limits; no transfer car or station, however, shall be maintained.

IMPROVEMENTS AND REPAIRS.

Section 10 requires the company to pay for the paving between all rails, including the space between double tracks or tracks and switches, and for a distance of eighteen inches outside of the outer rails with granite blocks on concrete foundation or with the same material as is used on the rest of the street or at the discretion of the board of public works. The company shall be assessed for such part of the improvement by the board of public works and shall pay in the same manner as do abutting property-holders who do not take the benefit of the ten year plan. On streets that have been heretofore paved, on which there are now car tracks, where the paving of that part of such streets as is occupied by such tracks has been paid for by abutting property-holders, the company shall within one year pay into the city treasury the cost of so much of said pavements as is included between tracks and rails, and such sum shall be paid pro rata by the treasurer to the property-holders against whom the cost of said improvement was assessed.

This refers to brick, granite or asphalt streets.

Section 11 stipulates that the company shall keep its portion of the streets in repair, and at all street crossings not paved the space between rails and for ten inches on the outside of rails shall be planked by the company to the full width of the street and sidewalk crossed by the tracks. In Section 12 it is provided that the company shall sweep, clean and sprinkle the portion of the streets occupied by its tracks when such streets are cleaned and sprinkled by the city. The company may elect to do its own cleaning and sprinkling, otherwise the board shall cause the same to be done at the expense of the company, in the usual manner.

In Section 13 it is provided that the tracks shall be located on such parts of streets as shall be approved by the board, and the board reserves the right to designate on what streets double and single tracks shall be laid. Section 14 relates to the kind of rail used and provides that it shall not impede the passage of vehicles nor the flow of water. The right of action against the company for violation of this and other sections is stipulated.

EQUIPMENT OF THE LINES.

By Section 15 the company is required to use first-class equipment; to provide conductors, in addition to motormen or drivers, for all cars; to provide for the heating and lighting of cars by electricity or other means acceptable to the board, and to provide life-guards.

In Section 16 the company is required to do all in its power to advance any street improvements by moving tracks, poles, etc. By Section 17 the operation of cars may be temporarily stopped by order of the board, and by Section 18 it is provided that in time of danger from fire or other cause the fire department chief may order any of the company's wires cut. Cars shall not be allowed to run over any hose belonging to the fire department.

PROVISION FOR TIME SCHEDULE.

Section 19 provides that cars shall be run over each line on a schedule not exceeding ten minutes between cars between 6 A. M. and 11:30 P. M., and not less than one car each hour thereafter until 6 A. M.; but upon said cars between the hours of 1 A. M. and 4 A. M. the company shall have the right to charge 10 cents a passenger; and it is further provided that upon such lines as may be agreed upon by the board and the company the latter may be relieved of running cars after midnight, provided that it agrees to run cars upon any or all of its lines at such intervals as may be necessary to provide ample accommodations.

The speed of cars is limited by Section 20 to twelve miles an hour, and six miles an hour at such crossings as the board may designate. Cars shall stop at the further side of crossings. Penalties for violations of this are provided.

By Section 21 it is stipulated that the city shall not be liable, independently or jointly with the company, for accidents that occur in the construction or operation of the lines; and the company agrees to pay any judgments obtained against the city for damages caused by the fault of the company, and hold the city free from harm.

By Section 22 the company receiving this charter is required to have in operation at least six miles

of line within six months, and all the lines by November 1, 1894. However, if by litigation the successful bidder is kept out of possession of the streets, it can have six years from the date of the signing of the contract in which to secure the streets for its lines, but it must begin work as soon as it is in possession of the streets.

Should the company holding the franchise sell or lease its property and rights to any other company, or should it make any extensions or purchase other lines, it is required by Section 23 to furnish, without extra charge, to each passenger desiring it, a transfer ticket, good on any line belonging to the company issuing such ticket.

PURCHASE, EXTENSION AND OTHER COMPANIES.

Section 24 says that at the expiration of this contract, or in case of forfeiture by reason of failure to comply with its conditions, the board of public works, with the approval of the council, may order an appraisement of the company's property and purchase the same at that value. One of the appraisers shall be selected by the mayor, one by the circuit judge and the third by the company.

If it be deemed desirable by the city to have constructed additional lines on streets not occupied by tracks of the company, Section 25 provides that the city shall notify the company to build the same; and should the company not notify the city within thirty days that it will build the lines as directed, or having notified the city, should it not within twenty days thereafter begin work, and should it not complete the work within reasonable time to be fixed by the council and board, provided no work be required between December 1 and March 15, the board and council may grant to other persons the right to build said lines. And the said grant shall confer upon said other individual the right to run over the tracks of the party of the second part within the territory bounded by Mississippi, Alabama, South and Michigan streets, for the use of which the party of the second part shall be paid on a wheelage basis, and in addition thereto a percentage of the cost of that portion of the lines used, a pro rata of the cost of the repairs and maintenance and damage to business of the party of the second part. In case of disagreement arbitration is provided for between the party of the second part and the other company. And such new line granted and built as aforesaid—no matter by whom operated—shall be operated with the right of transfer to or from all cars of the party of the second part and said new line in the same manner and under the same conditions as are provided for transfers of passengers for lines and cars of the party of the second part. The pro rata amount of the fare of such transfers due to either of said companies shall be determined by the companies — they failing to agree, the differences shall be referred to experts. If the party of the first part, after having directed the party of the second part to build any new line as hereinbefore in the section provided, and the territory along said proposed line has one-half of the lots built upon, and two-thirds of the length of said proposed line is at least two squares distant from any other parallel street car line, and the party of the first part has failed to secure the building of said lines by the means hereinbefore provided in this sec-

tion, then and in that event the party of the first part may again notify the party of the second part to build said line, and on the failure or refusal of the party of the second part to begin said line as aforesaid within thirty days thereafter, or upon the failure of the party of the second part to complete the same within a reasonable time thereafter, said time to be fixed by the board of public works and common council of said city, then in case of failure or refusal in either of such cases the party of the second part shall pay as liquidated damages to the party of the first part the sum of $25 a day for each and every day that said work remains uncompleted after the expiration of the time fixed for its completion by the said board and common council, and the bond provided herein to be given by said company shall be made to include, and shall include, as one of its conditions, the payment of such damages.

The company shall operate its lines, Section 26 provides, in conformity with laws and ordinances.

BOND REQUIRED.

Section 27 provides that any company, before exercising any of the rights granted, shall execute to the city a bond of $100,000, conditioned that the company shall pay to the city any money that has been paid by the city because of any work done that under this agreement is provided to be done and paid for by the company on the demand of the city, and said bond shall be renewed from time to time upon the demand of the city.

FORFEITURES.

Section 28 says that in case the company violates any of the terms or obligations of the charter, all privileges granted shall then be subject to immediate forfeiture, and shall revert back to the city, and the contract shall become null and and void, except where different penalties are provided in the agreement; and in such event the city shall have the right to remove the company's poles, rails, tracks, etc., and a right of action for breach of contract shall immediately accrue upon the bond of the company for any injury or damage arising out of this breach of contract.

Section 29 provides that to each of the terms, conditions, stipulations and requirements of this contract the board of public works, representing the city of Indianapolis, the party of the first part, and the ———, the party of the second part by its duly authorized officers and representatives, fully agree and bind themselves, their successors and assigns.

COMPETITION IN ASPHALT PAVING.

WASHINGTON, D. C., April 19 (Special Correspondence).—Efforts are being made to break the alleged monopoly of laying asphalt pavements in the District of Columbia. For many years the Barber Asphalt Company and the Cranford Paving Company have had no competition in the work of laying and repairing asphalt pavements here. The reason for this practical monopoly has been that no asphalt has been offered which it is believed could equal the quality furnished by the Barber company, which had obtained the concession from Great Britain to use the product of the pitch lake on the island of Trinidad. There have, however, been numerous attempts to introduce another quality of asphalt, denominated land asphalt, which the commissioners have always refused to consider because

the examination by the inspectors of asphalt and cement has represented it to be somewhat inferior to the lake product.

Considerable surprise was therefore manifested at the recent opening of bids for laying and repairing asphalt pavements in this city during the coming fiscal year, when Thomas H. Thomas, of South Amboy, New Jersey, offered to furnish the necessary lake asphalt at an amount about two per cent. lower than either the Barber or Cranford companies had bid.

Little is known of Mr. Thomas, although when the bids were opened Prof. De Smedt, for many years District chemist, appeared in his behalf, and it is understood is connected with him in the business. The first question naturally asked was where the new company obtained its asphalt, for the asphalt used in laying pavements in the District of Columbia is that which is controlled exclusively by the Barber company, as already mentioned.

Some time ago an effort was made to organize a competing company, known as the Schillinger Paving Company, to lay pavements in the District with the land pitch, and although the inspector of asphalt and cements reported against the use of this material, the commissioners of the District determined to give the new contractors a trial, and awarded them a street to pave on which they were the lowest bidders, and requested the posting of a bond as a guarantee of good faith, but the bond never materialized, and the order of the commissioners was revoked, and the street in question awarded the Barber Asphalt Paving Company.

As stated, the commissioners inquired where this new asphalt came from, and the reply was that it was imported from Venezuela. The only pavements laid with this asphalt by this new company, as far as is known, were in Detroit, Michigan, but as they have not been laid long enough to judge of the wear and tear incident to heavy traffic and the weather, it is believed that the commissioners will not attach too much importance to their present condition. A sample of this asphalt will be sent to the inspector of asphalt and cements for investigation and report.

Immediately upon receiving the bid of Mr. Thomas, the District Chemist was dispatched to South Amboy, New Jersey, where the works of this company are located, for the purpose of obtaining samples and examining their plants. Captain Fiebeger has since returned, and reported that he found that Mr. Thomas has four stills in operation for refining the lake asphalt. He has also a large quantity, amounting to about 700 tons of the refined article, already in barrels. The samples which Captain Fiebeger brought with him will be at once subjected to a rigid test, and if the asphalt equals the Barber article the contract will undoubtedly be awarded to the new contractors, who have underbid the Barber and Cranford Companies. There is about $150,000 involved in the matter, and the outcome of these tests will be watched with a good deal of interest.

DESTRUCTION OF GARBAGE.

The National Sanitary Company, which has the contract for removing the garbage of this city, put into operation on the 19th their crematory for incinerating garbage. For this work Congress recently authorized the commissioners to

pay 50 cents a ton. Major Ferguson, president of the company, several days prior to the commencement of the plan, requested the commissioners to appoint a representative of the District Government to supervise the weighing of the garbage delivered at the furnace. He also inquired what arrangements the commissioners would make with reference to the contract of destroying the garbage. The commissioners replied that they were not prepared to make any permanent arrangements for the purpose, but that they would allow the National Sanitary Company to destroy the garbage, with the understanding that said company would take the chances of having an interpretation of the law in favor of paying for the work done under this tentative understanding.

The Sanitary Company is now carrying out the garbage contract originally let to Mr. Clark. Lately it has been able to gather only 35 tons of garbage daily. It is highly probable that the amount it will collect, when paid 50 cents per ton for incinerating, will be considerably enlarged.

A NEW SYSTEM OF STREET SWEEPING.

The commissioners of the District have decided upon a complete reorganization of the street sweeping department, and on the 15th instant new systems and new methods were introduced in the cleaning of Washington streets. For some time past the subject of street sweeping has occupied the attention of the commissioners. They believed that the hundreds of complaints that came in concerning the condition of the streets in all sections had some foundation, and after considering the matter a short time decided that the trouble lay in the system of inspection and the methods of sweeping. One of the greatest defects was in the inspection of the work. All of the inspectors were on an equal footing, and one refused to take orders from another. This complicated matters and brought about a condition of affairs in the street sweeping department that was not desirable and not conducive to the public interest. To remedy this matter the commissioners will, upon the reorganization of the department, appoint one inspector and make the other inspectors his assistants. New schedules will be made out, and the superintendent of street sweeping will be ordered to enforce a strict compliance of the contract.

ON A TOUR OF INSPECTION.

A delegation consisting of thirty-seven city officials and prominent business men of Detroit, Michigan, visited Washington recently on a tour of inspection for the purpose of examining municipal improvements that have been made in Washington and are being made. It was their idea to visit a number of important cities and profit by the experience of others in the betterment of their home city of Detroit. While here, they inspected our conduit system, for they proposed placing all of their wire underground in Detroit. They also examined our cable and electric roads, our school system, illuminating plants, and in fact all other points of municipal interest. The delegation was headed by Mayor H. S. Pingree, and included the board of aldermen, the president of the board of public works and the heads of the different city departments. A. I. P.

PAVING BRICK IN HARTFORD, CONN.

The twenty-first annual report of the street commissioners of Hartford, Conn., George G. Sill, Chas. H. Northam, William E. Cone, James Burns, James U. Trainor, and Charles S. Davidson, states that after a careful investigation of the merits of granite, asphalt and brick as street paving materials, it was decided to try brick and Pratt street was paved with this material. They say: "The work was duly completed in the best manner, and it presents a clean and smooth surface, and has become a desirable street for heavy and light vehicles. So far it has met our hopes and expectations. If, after further wear, it continues sound, level and unbroken, we shall think we have found a good quality of paving. The freight on these bricks was greater than the cost of the bricks. It would seem that when clay is so abundant as in this vicinity similar bricks might be made here, and supplied at one-half the cost of those used."

ENGINEERS AT THE WORLD'S FAIR.

Notice is given by the committee that the reception rooms and office of the general and executive committees of the Associated Engineering Societies of the United States and Canada, and of the general committee of the World's Congress Auxiliary on the International Engineering Congress, on and after May 1st, 1893, and until the close of the World's Columbian Exposition, will be at No. 10 Van Buren street, Chicago. All communications after May 1st should be addressed to, or to the care of, Mr. Max E. Schmidt, secretary. Visiting engineers may have their mail thus addressed. The committee rooms of the Associated Societies at the exposition will be situated in the southwest corner of the gallery of the Mines and Mining building, where the secretary or some of the staff will be present during the Exposition to meet visiting engineers.

NEED OF BETTER SEWERAGE AT LOUISVILLE.

A sanitary survey of Louisville, Ky., has been completed by Mr. Rudolph Hering, who reports the death rate as being from 18 to 20 per 1,000, much of which is due to typhoid and other preventable diseases. He recommended the extension of the sewerage system; only one-third of the houses adjacent to present sewers being connected with them. The water supply from the Ohio river is not even suspicious, but the water from wells is condemned. Intercepting sewers and the improved final disposal of the sewage are recommended.

RELATIVE COST OF BRICK AND GRANITE PAVEMENTS.

Mr. George B. Fleece, commenting on statements in the recent annual report of City Engineer Meriwether, of Memphis, says:

"Maj. Meriwether says a brick pavement will last, without repairs, under a traffic of 40 or 50 tons per square foot, about 8 or 10 years, but how much longer, he does not state. It is fairly presumable, however, that the life of a pavement that required no repairs in 10 years would extend to at least 15 years before final disruption. He estimates the life of granite, under heavy travel, at 15 to 20 years. We will assume that the city engineer is correct, putting the life of granite pavement at 20 years and brick at 10 years,

and figure up financial problem involved.

Original cost of one mile granite..	$84,000
Interest on cost for 20 years.....	100,800
Total cost in 20 years	$184,800
Original cost of one mile brick	$47,000
Interest on cost for 20 years.....	56,400
Relaying at 10 years, at $1.50 per yard	28,500
Interest on cost of relaying for 10 years.....	17,100
Total cost in 20 years.....	$149,000
Balance in favor of brick.....	$35,800

"This balance in favor of brick would pay for laying a new pavement, thus extending the life of a brick pavement to 30 years—or 10 years beyond the estimated life of granite, and still leave a large balance in favor of brick over granite. Now repeat the estimates foregoing upon the basis of equal durability of granite and brick, placing both at 15 years, and the problem works out as follows:

One mile granite, original cost....	$84,000
Interest on cost for 15 years.....	75,600
Total cost in 15 years.....	$159,600
One mile brick, original cost.....	$47,000
Interest for 15 years.....	42,300
Total cost in 15 years.....	$89,300
Balance in favor of brick,.....	$70,600

"A surplus fund, the interest upon which, at 6 per cent. would largely exceed the cost of perpetual renewal of brick pavement.

"If, then, brick will last 15 years, it is far cheaper and better than granite, even if granite should last forever. It is the opinion of many who may be fairly considered authorities that brick will wear longer than granite."

FIR BLOCK PAVING IN TACOMA, WASH.

The city of Tacoma, Wash, is about to spend $72,000 on a fir block pavement on Pacific avenue. The entire pavement is to be 10½ inches in thickness. Of this, the lower six inches is to be of concrete, with the surface floated and smoothed with cement mortar. This will give a uniform surface on which to lay the blocks. The cement used in the concrete is to be of a tensile strength of 250 pounds to the square inch. Upon the concrete thus prepared wooden blocks 4½ inches thick are to be placed, the grain being vertical. The wood is to be taken from fir-butt logs, and the blocks will be 3 inches wide and 7 to 10 inches in length. A space three-eighths of an inch is left around each block. These spaces are to be run to a height of one-half inch with tar and asphalt. This is to bind the block to the concrete. Above this the crevices are to be filled with a cement grout. The specifications follow very closely the ones which have been so successfully used of late years in London and Paris.

DIRECTOR WINDRIM'S WORK.

Director of Public Works Windrim is pushing the paving of alleys in Philadelphia with asphalt in place of cobblestones. He fears that if cholera should reach this country this year there would be much difficulty in keeping the alleys of his city sufficiently clean. He is also making war on the street cleaning and garbage removing contractors, one of whom he has fined $5,000 for neglect of duty, making the fine $5 for each well-founded complaint from a householder. He will hereafter increase this fine on a sliding scale of $5 for each raise. His methods ought to prove effective.

RAPID TRANSIT BRINGS PROSPERITY.

As an example of what rapid transit facilities will do for thickly settled communities, it is interesting to note the effect of such facilities in Pittsburg, Pa. In the 19th, 20th and 21st wards of the city during the four years of 1889–92, there were erected 3,181 buildings at a cost of $6,910,838.50, while in the preceding eight years (1881–88) only 1,624 buildings were erected in the same wards at a cost of $2,945,608.37. Not only has the number of buildings increased, but the style has greatly improved, the average cost in 1887 having been only $2,040, while in 1892 it was $2,327.

SCARCITY OF PAVING BRICK IN THE WEST.

The annual report of William Steyh, city engineer of Burlington, Iowa, states that during last year the paving of streets there comprised 26,890 square yards, costing $49,307.59. He complains that much work has been delayed there by a scarcity of paving brick.

WATER USED IN PHILADELPHIA.

The average daily water consumption in Philadelphia for 1892 was 163,801,600 gallons, or about 160 gallons daily per head of population. The pumping capacity will be increased this year by the addition of a 20,000,000-gallon pump at the Spring Garden station, a 15,000,000-gallon pump at Frankford station and one 12,000,000-gallon pump at Roxborough. A new reservoir at Queen Lane is to be built at a cost of $1,159,591.

SOME RECENT INVENTIONS.

A Side Rail for Suspension Bridges, by Edwin G. Runyon, Pilot Point, Texas, consists of the necessary beams and floor cables, a casting on the ends of the beams having horizontal boxings through which the cables pass, arms on the castings, cross-bars secured to the castings having apertures in their ends, seats fitted in the apertures, saddles on the columns, a hand-rail, and diagonal truss cables, extending alternately over the saddles and below the needle beams.

A Sectional Mold for Building or Paving Blocks, by George M. Graham, Chicago, Ill., consisting of a mold housing, vertical walls or sections, and a lower frame connected to a section by hinges or pivots and provided with inturned flanges, and a lower plunger provided with top and bottom flanges.

A Pipe Coupling, by Orange M. Sweet, Silver Creek, N. Y., consisting of a cylinder casing having a port or passage, a cylinder block capable of turning in the casing and having a passage adapted to register with the port of the casing and an internal cylindrical socket and a cylindrical knuckle fitted in the socket of the block and having a passage adapted to coincide with the passage of the block.

A Joint for Gas or Water Pipes, by Gordon W. Lloyd, Detroit, Mich., consisting of the abutting ends of the pipes, a folded flexible packing thereon with the fold at the joint interposed between the ends, ribs formed on the pipes near the ends, and apertured sleeves embracing the joint and overlapping the ribs at each end, forming a chamber, the ends of which are formed by the ribs, the outer wall by the sleeve, the inner wall by the pipe and a filling of cement in the chamber.

A Bridge Gate, by Henry Roessing, Chicago, Ill., consisting of a

swing bridge and its abutment, a housing forming a narrow trench in the abutment, a folding gate comprising bars pivoted in the housing to swing upward on their pivots from a folded position in the housing, to extend upward in unfolded position from the housing, a rail pivoted to the ends of the bars and fitting over and closing the top of the trench when the bars are folded, and movable with the bars to form the top rail of the gate when the bars are raised on their pivots, gear mechanism on the bridge, and operating gear mechanism for the gate on the abutment in the path of the gear mechanism on the bridge, to be actuated thereby to fold the gate as the bridge is unclosed and unfold the gate as the bridge is opened.

A Bridge, assigned to Richard M. Scruggs, St. Louis, Mo., consisting of a lower member, the upper member and the underneath truss, the lower member having a vertical series of horizontal chords spaced apart from each other, the upper member being arched, and the members and underneath truss being connected at the ends and the central portion of the truss.

A Metallic Culvert, assigned to Emmons T. and Morice C. Trumbull and James B. Disbrow, Savona, N. Y., consisting of a sheet iron arch having iron braces provided at their ends with suitable notches, and strips having grooves, with converging sides, adapted to catch in the notches of the braces.

A Glass Pipe Casting Machine, by Roderic G. Guptil, Pendleton, Ind., consisting of a frame work, a mold adjustable supported thereon, a movable core connected with a plunger supported above and in line with the mold, such core adapted to be raised and lowered by means of a friction clutch mechanism supported above the framework, such mold centered and closed at its lower end by a removable pivoted plug.

A Building Block, by John Heatley, Pittsburgh, Pa., consisting of a locking projection enclosing one corner, and its faces tapered toward the opposite end.

V. H. Lockwood, Patent Att'y.
Indianapolis.

RECENT LEGAL DECISIONS.

Drainage of Surface Water Into Highway.—The owner of land adjoining a highway has no right to drain his land into a ditch in such highway by means of a drain which carries the water in a different direction from its natural flow. The statute which forbids the obstruction of highways by ditches, and authorizes the highway commissioners to fill up such ditches, "except the ditches necessary to the drainage of an adjoining farm emptying into a ditch upon the highway," allows them to fill up a drain which empties into a ditch on the highway where such drain, in order to reach the ditch, diverts the water from its natural course. Davis *v.* Comm. of Highways, Supr. Ct. Ill., 33 N. E. Rep. 58.

Damage to Street Railway by Construction of Sewer.—The location of a sewer in a city street must be reasonable, with respect to the right of a street railway the construction of which was authorized by a prior ordinance and whose property might be damaged by the construction of such sewer; and such location, if made in a part of the street occupied by the railway so as to compel it to suspend operations, and inflict great damage upon it, is unreasonable

when other parts of the street are equally suitable for the sewer. But the city is not required to incur any additional expense by reason of having authorized the building of such road. Clapp *v.* City of Spokane, U. S. Circ. Ct., D. Washington, 53 Fed. Rep. 515.

Liability of City for Damages from Street Improvements.—A city, in opening a street, took property on which was located one-half of a double brick house, the other half of which was owned by one other person; and the latter half of the building was greatly damaged. As it was thought no compensation could be allowed the owner, because none of his property was actually taken, the city council requested the legislature to pass an act, authorizing it to make compensation, which was done. While the bill was pending in the legislature, the owner of the property made a contract with the city by which it sold him the portion of the building taken, and he released it from all claims for damages; proceedings by the owner, under the act, to compel the city to make compensation, should not be stayed because of such contract, it appearing by the affidavits filed on his behalf that he signed the contract on the assurance of the corporation counsel that he could procure a small strip of land, left between his half of the building and the street, so as to restore his building to a proper condition, and that he was unable to do so; and that the expense of taking down and removing the property sold him by the city was equal to its value; but, if there was any excess of such value over the expense, he should be compelled to allow it in reduction of damages. In re Elmwood Ave., 21 N. Y. Sup. 592; Supr. Ct. of Buffalo.

Liability of Owner for Paving Street.—Property owners are not liable to an assessment for paving a strip previously macadamized, in the middle of the street, at expense of the property. City of Philadelphia, to use of Vulcanite Paving Co., *v.* Eheret, Supr. Ct. of Penn., Jan. 30; 25 At. Rep. 888.

Mandamus to Board of Aldermen.—Where, at a municipal election, there has been no choice, and at a second election there has been no choice, and the board of aldermen order a third election on the first of the month following, mandamus will not lie at the relation of certain candidates for office to compel the board to order an election at an earlier day, as such relators have only an interest in common with the rest of the public, and are not entitled to petition in their own names. O'Brien *v.* Board of Aldermen of City of Pawtucket, Supr. Ct. of Rhode Island, Dec. 28, 1892; 25 At. Rep. 914.

Negligence in Maintaining Defective Bridge.—Where a child fell through a bridge into a canal, in consequence of negligence in permitting an opening to remain unguarded, and without contributory negligence on the part of its parents, and the father, in an effort to rescue the child, plunged into the canal, and both were drowned, the death of both must be attributed to negligence in maintaining the unsafe bridge. Gibney *v.* State, Court of Appeals of New York, Jan. 17, 1893; 33 N. E. Rep. 142.

PERSONALS.

Mr. D. M. Starr has been elected city surveyor of Litchfield, Ill.

Mr. L. E. Chapin, of Canton, Ohio, is engaged in preparing a sewerage system for Alliance, Ohio.

Mr. Harvey Linton has been re-elected city engineer of Altoona, Pa.

Mr. H. M. McIntosh has been elected city engineer of Burlington, Vt.

Mr. T. L. Kennerdell has been elected city engineer of Franklin, Pa.

Mr. Joseph P. Phillips has been appointed city engineer of Scranton, Pa.

Mr. E. B. Baker has been appointed city engineer of Gloversville, N. Y.

Mr. G. W. Woodward has resigned his position as city engineer of Hastings, Neb.

Mr. Rudolph Hering has been engaged to design a system of sewerage for Charlottesville, Va.

Mr. James B. Gass has been re-elected city engineer and superintendent of sewers at Fort Smith, Ark.

Mr. R. A. Bryan, who has been city civil engineer of Portsmouth, Ohio, for thirteen years, has resigned.

Mr. L. W. Burt, city surveyor of Hartford, Conn., has had his salary raised from $2,000 to $2,500 per year, by a unanimous vote of the council.

Mr. William Steyh, of Burlington Ia., has been re-elected city engineer. This is his eleventh year of service with the city.

Mr. Lewis Kingman has been reappointed city engineer of Topeka, Kan., for a term of two years. He has already served four years.

Mr. W. T. Sanborn, who was for some time connected with the Dover (N. H.) Gas Light Company, has retired from the gas business.

Dr. F. P. Vandenburgh, of the Vandenburgh Laboratory of Chemical Industry, Buffalo, N. Y., has returned from a professional examination of the asphalt deposits in Trinidad and Venezuela.

Mr. John A. Cabot, formerly with the Cincinnati Edison Company, was appointed city electrician of Cincinnati. He takes the place of Mr. Rob MacKie, who has accepted the position of chief engineer of the "C. & C." Electric Motor Co.

Maj. J. W. Howard will be in charge of the exhibit of the Barber Asphalt Paving Company in the department of mines and mining, at the Columbian Exposition. He is also to make tests and records of traction on different roads and pavements for the Department of Agriculture.

LETTERS FOR THE PUBLIC.

SLAG FOUNDATIONS UNSATISFACTORY.

To the Editor of Paving and Municipal Engineering:

SIR—Noticing in your April number, page 242, the statement that concrete was not used as a foundation for brick pavements in Youngstown and other cities named, but that slag from gas works and broken stone is considered better, I beg permission to correct the statement so far as Youngstown is concerned. Slag from blast furnaces was used here at one time, but it gave unsatisfactory results and its use has been abandoned for foundations and concrete substituted in its place. We regard a

first-class foundation as essential to the life of a brick pavement.

F. M. Lillie, City Civil Engineer.
Youngstown, O., April 14, 1893.

WORKS ON SEWERAGE AND SEWAGE DISPOSAL.

To the Editor of Paving and Municipal Engineering:

SIR—Please give me the titles of some works on sewerage and sewage disposal. *J. C. B.*
Sacramento, Cal.

A few references to such works, cited by Mr. Wolcott C. Foster, are the following:

Gray (Samuel M.), Report on Sewerage to City of Providence, R. I. (Describes European practice.) An excellent work.

Adams on Sewers and Drains.

Staley and Pierson's Separate System of Sewerage.

Broom on Sewage Disposal.

Phillips on Sewage.

Tidy, Treatment of Sewage.

Latham's Sanitary Engineering.

Coefield, Sewerage and Sewage Utilization.

Waring, Sewerage and Land Drainage.

Baumeister, Cleaning and Sewerage of Cities.

Flynn, Hydraulic Tables for Sewer Pipes, etc.

Robinson on Sewage Disposal.

Crimp in Mins. Proc. Inst. C. E.'s, Vol. XXXVIII, p. 178.

A GOOD PLACE FOR A PAVING BLOCK PLANT.

To the Editor of Paving and Municipal Engineering:

The matter of paving our streets is being agitated, and suitable ordinances have been passed for paving under the special assessment plan. It costs us thousands of dollars each year to keep our roads in repair. They are clay, and being situated near high bluffs, they wash badly in every hard rain. We have the fire clay, soapstone, shale and brick clay at hand for making brick of any kind. We have only one small brick plant here in the city making a few building brick each year. This would be an excellent location for a large brick or fire-proof construction plant, and if the streets are paved this season, as undoubtedly some will be, it will make some work for the brick business.

C. L. Stinson, City Clerk.
Marseilles, Ill., April 9, 1893.

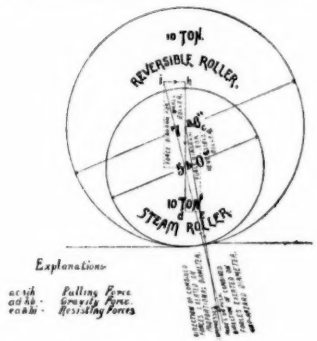
MACHINERY AND TRADE.

POPE'S REVERSIBLE ROLLER.

It is a popular theory that it is weight in a roller that produces compactness in road building. Sufficient importance is not attached to the diameter of the roller. In combating this theory, the claim is made that the trouble with some of the steam rollers is due to the fact that, with an average of five feet in diameter, they carry an average load of 15 tons. The argument is made against this that larger proportional diameter has more bearing on the street than rollers of smaller diameters; thus, in one respect, overcoming the liability of stalling in soft places.

This is the claim which Mr. R. C. Pope has been making in behalf of his reversible roller and he offers figures to demonstrate that a 7-ton reversible roller is more efficient than a 12-ton steam roller, as fol-

lows: A 12-ton steam roller carries 12 tons on 92 lineal inches of bearing, making 260 pounds per lineal inch, while a 7-ton reversible roller carries 7 tons on 60 lineal inches, making 233 pounds per lineal inch.



The accompanying drawing illustrates the comparison that he aims to make, exhibiting a diagram of forces showing the gravity, resistant and pulling forces, the two latter having been reduced to a minimum, and the gravity force increased. The diameters of reversible rollers are calculated in reference to this principle and represent 333⅓ pounds per one inch diameter. In connection with this showing, it is argued that less stone and thin layers with more rolling make better roads at less cost.

Mr. Pope's rollers have come into quite general use. Twenty-two of them are owned by the city of St. Louis, and among the places where sales have recently been made are Evansville, LaFayette, Ind., Louisville, Ky., Chicago, Quincy, Ill., and Indianapolis, where experience with it is reported to be quite satisfactory. One of the advantages of his roller is that it is controlled by one shaft. It is widely known as a foundation roller and is also very largely used in the construction of brick paved streets, having been used in probably seventy-five per cent. of such streets.

OIL ENGINES FOR STREET CARS.

An application of the gas or oil engine to the propulsion of street cars is to be found in Chicago, where the Yerkes syndicate are experimenting on a practical scale with the Connelly motor. An oil engine company at Dessau, Germany, is offering to equip a line of street cars at Erfurt in the same empire. At that city the horse cars are to be given up, and it was intended to ask the Thomson-Houston company to erect an overhead electric line until the oil engine proposition was brought forward. It is very doubtful whether a system of cars driven by oil engines can ever be worked as cheaply as the overhead electric system, on account of the weight of the engine and tank of oil that necessarily forms part of the load of each car. At the present time a commission is investigating the relative merits of the overhead electric and oil engine systems as applicable to the Erfurt street lines.

The Connelly motor was tried for a time in Elizabeth, N. J., with very unsatisfactory results. It is said, however, that improvements have been made in the motor since then.

NOTES.

Another new catalogue of forty pages, handsomely printed and freely illustrated, has just been issued by J. W. Penfield & Son.

A new company has organized at Anderson, Ind., to manufacture vitrified paving brick. Messrs. Goff & Slayback are the promoters. The company will buy the brickyard of Jones & Clemans, of that place, and will convert the yard into a paving brick factory.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

More paving is talked of at Decatur, Ill.

Paving is talked of at Chillicothe, Ohio.

Crawfordsville, Ind., is about to begin a system of paving.

Oskaloosa, Iowa, is discussing the question of more paving.

There is talk of paving West Eleventh street, Anderson, Ind.

Chestnut Hill avenue and Boylston street, Boston, are to be widened.

H. C. Schultz, city clerk of Waterloo, Iowa, writes that that city contemplates paving.

A fine driveway six miles long will probably be built between Allegheny City and Perrysville, Pa.

The question of paving the principal business streets is being discussed to some extent at Peru, Ill.

Emery D. Irelan, city clerk of Atlantic City, N. J., writes that the city contemplates paving at an early date.

W. A. Gray, of Danbury, Conn., writes that the city may do some granite block paving in the near future.

E. B. Parsons, city engineer of Fond du Lac, Wis., writes that paving on various streets is contemplated this season.

F. W. Allison, clerk of Salem, Ohio, writes that petitions are being circulated, and it is probable that a number of streets will be paved this season.

Muscatine, Iowa, contemplates paving Second and Third streets with brick. The commercial club has been securing estimates of the probable cost.

L. C. Kelsey, clerk of Elyria, Ohio, writes that some of the streets of that place will be paved with brick this summer. The contracts will not be let until June.

Muskingum county, Ohio, is preparing to take the lead in the experiment of paving county roads with paving brick. It is proposed to pave the river road south from Zanesville to the first bridge, a distance of four miles, half the money to be raised by private subscription and the other half to come from the township and county.

J. M. Kennedy, clerk of Aurora, Ill., writes that a considerable amount of paving, consisting mostly of cedar blocks, will be put down in that city this season.

Ed Hough, city clerk of Sedalia, Mo., reports resolutions for paving on about a dozen different streets. The outlook is good for a great deal of street improvements this season.

There is a movement on foot among the residents of Arlington avenue, Des Moines, Iowa, to put a top dressing of asphalt on the brick pavement from State street to the river. The residents also intend to beautify the parking by planting flowers the whole length of the avenue.

CONTRACTS TO BE LET.

Fourth street, Williamsport, Pa., is to be paved.

A mile of brick street is to be constructed in Covington, Ky.

The business streets of Riverside, Cal., are to be paved at once.

Rochester, N. Y., will soon want bids for Medina stone and asphalt paving.

Plans have been prepared for paving on about twenty-five streets of New Orleans, La.

About twenty miles of macadam roadway will be constructed near Wyandotte, Mich.

City Engineer Culver, of Salem, Oregon, has prepared plans for paving on various streets.

Paving in Charleston, Ill., is now an assured thing. The council will advertise for bids.

East Bridge street, Plainfield avenue and Scribner street, Grand Rapids, Mich., are to be paved.

Parts of Scott, State, Greenup and Garrard streets, Covington, Ky., are to be paved with brick.

The city engineer of Salt Lake City, Utah, has prepared estimates for paving on a number of streets.

E. E. Forbes, city auditor of Clinton, Ia., writes that bids will be opened May 9 for two blocks brick paving.

Fayette street, from Market to East streets, Washington, Ohio is to be graded, curbed and paved with brick.

A number of residence streets will be paved next summer in Sioux City, Iowa. Brick will probably be chosen.

The court has authorized the proposed increase of the debt of Jenkintown, Pa., $30,000 to macadamize the streets.

An ordinance has been passed for the extension of Jackson Boulevard, Chicago, through the Garfield driving park.

The business portions of Colorado street and Raymond and Fair Oaks avenues, Pasadena, Cal., are to be asphalted.

Moliter street and McLean avenue, Cincinnati, will be paved with brick. Granite blocks will be laid on Butler street.

Albert E. Andrews, city clerk of Warren, Ohio, writes that proposals will be received, May 8, for paving with brick, granite, asphalt or asphalt block, Mahoney Ave. and Main St.

A fifty-foot roadway on West Third street, Williamsport, Pa., will be paved, probably with asphalt. There will be a seven-foot sidewalk and an eight-foot parkway on each side of the road.

Walnut, Fourth, Fifth, Sixth, Seventh, Eighth, Ninth, Tenth and Eleventh streets, Des Moines, Iowa, will be paved with brick except the distance between Court avenue and Vine, which in each case will be paved with granite.

Geo. T. Day, city clerk of Union City, Ind., writes that declaratory resolutions have been passed providing for the grading, graveling, curbing and sidewalking of Walnut street from Division to Pearl, and of High street from Hickory to Pearl.

Franklin, Pa., is agitating the street paving question. There is a demand for the repaving of the north and south ends of Thirteenth street, and South Park street entire, this summer. The city engineer has been instructed to furnish estimates.

J. J. Matt, of Far Rockaway, N. Y., reports that a resolution has been passed for the macadamizing of about forty-two miles of highways in the town of Hempstead, at an average cost not to exceed $10,000 per mile, the macadam not to exceed eighteen feet in width.

John Macdonald, clerk of Brazil, Ind., writes that the city council will receive bids until June 20, for sawed stone flagging sidewalks, two inches thick, for each side of Lambert street, from Main to Ridge streets, a distance of about 1,200 feet, and for each side of Franklin street, for a distance of about 1,200 feet; also, for finishing unsawed stone flagging sidewalk four inches thick, on each side of Meridian street.

That the sanitary condition of Philadelphia may be better, the city will pave with sheet asphaltum the small streets of the city. The sections to be paved are divided into eight districts and proposals asked for separately, in order that the work may be done as speedily as possible.

J. W. Sedgwick, city engineer of Pasadena, Cal., reports that he has been instructed to prepare specifications for paving with asphalt portions of Fair Oaks avenue, Raymond avenue and Colorado street. Contract for grading, guttering and curbing about one-half mile of North Raymond avenue has been let to Mushrush & Carson at 87½ cents per lineal foot. Resolutions have been passed for cement sidewalks on various streets.

The Indianapolis Board of Public Works will receive bids for paving with asphalt: Talbot avenue, from Fourteenth to Seventeenth streets, May 12; Broadway, from St. Clair to Seventh streets, May 12; Pennsylvania street, from Virginia avenue to Maryland street, May 12; Arsenal avenue, from Washington to Michigan streets, May 19; Shelby street, from Coburn to Pleasant Run, May 19; Walnut street, from Meridian to Tennessee streets, May 15. Bids for brick pavements on various streets will be received on May 3.

CONTRACTS AWARDED.

Henry S. Hallwood has been awarded the contract at $1.79 for paving with Hallwood block 66,000 square yards of streets in Evansville, Ind.

The Department of public works of New York City has awarded numerous paving contracts to the Barber Asphalt Paving Company at a total of $244,731.75, and to the Sicilian Asphalt Company at $109,-236.18.

The Pacific Paving Co., of Utah, have the contract for paving West Temple street between South Temple and Fourth South streets, Salt Lake City. Their bid was: Curbing, 5,000 feet, at $1.00, $5,000; flagstone, 6,000 feet at 73 cents, $4,380; stone blocks, 6,000 square yards at $3.15, $18,900; asphaltum, 15,000 square yards at $2.97, $44,550; total, $72,830. The other bidders were the Culmer-Jennings Paving Company and Ryan & Griffin.

The following contracts for paving in Dayton, Ohio, have been let: Bridge street, Trinidad Asphalt Company, $10,506; Brown street, from alley south of Buckeye street to Oak street, Berry & Davis, Bellaire, Ohio, Canton metropolitan block, $19,377.50; Brown street, from Fifth street to alley south of Buckeye, Berry & Davis, Canton metropolitan block, $22,186.50; Brown street from Oak street to Fairground avenue, M. G. Cain & Co., East Clayton block, $20,364; Fourth street, from Jefferson street

to the canal, Trinidad Asphalt Company, $1,119.14; Kenton street, M. G. Cain & Co., Medina stone, $5,395.75.

A contract for paving with asphalt in Erie, Pa., has been awarded to the Erie Paving Company at $3.00 per square yard with a guarantee for ten years. The Trinidad Asphalt Company, of New York, bid $3.15.

SEWERAGE.

Saginaw, Mich., will spend $57,925.26 for sewers this summer.

Portland, Oregon, is now building the largest sewer on the Pacific coast. It is being constructed of brick and stone, on E. Alder St. It will be 2½ miles in length and cost $116,512.17.

CONTEMPLATED WORK.

A system of sewers will be built at Brunswick, Me.

The council of Scottdale, Pa., has voted to ascertain the cost of a sewerage system.

The sewerage system question is being agitated by the people of Flemington, N. J.

The Chillicothe, Ohio, board of trade is agitating the question of a sewerage system.

The question of sewerage is uppermost in the minds of the citizens of Monticello, Ind.

The great need of a good sewerage system for Plainfield, N. J., is being discussed there.

It is estimated that the total cost of sewering district A, Sioux Falls, S. D., will be $317,000.

Glenwood Springs, Colo., is agitating the question of a better sanitary condition and a sewerage system.

The question of sewerage is being discussed at Fort Dodge, Kan. The bids will probably be wanted soon.

The city of Colorado Springs, Colo., proposes to issue $35,000 in bonds to extend the city sewerage system.

The sewer committee of Cohoes, N. Y., has recommended the construction of a main sewer across the city.

The town committee of Moorestown, N. J., has recommended a system of sewers to cost from $40,000 to $50,000.

The street commissioners of Malden, Mass., have requested that $150,000 be appropriated as soon as practicable for sewers.

Mr. J. W. Howson is president of the sewer commission recently organized at Cazenovia, N. Y., for the purpose of having a careful survey made and having the question of sewers submitted to the people.

The citizens of Jamestown, N. D., especially the business men, are agitating the question of a sewerage system for the town.

J. S. Smith, clerk of Canandaigua, N. Y., writes that that village contemplates building several short sewers during the season.

A committee has been appointed at Paso Robles, Cal., to investigate the question of a sewer system and the proposed issue of sewer bonds for about $60,000.

F. W. Puderer, clerk of Belleville, Ill., writes that the city council has closed a contract with Engineer Edward Fladd, of St. Louis, Mo., for plans of a complete sewerage system for the city.

St. Louis, Mo., has 62 miles of main sewers and 276 miles of lateral sewers. They have cost $7,628,383.31. The city now has in contemplation the turning of the River des Peres into a sewer, from its mouth to where it leaves the city boundaries on the northwest. As it is one of the crookedest streams that flows, the distance is 37 miles, and the total cost of the work will reach $13,000,000. It will afford drainage for every portion of the unsewered part of the city.

CONTRACTS TO BE LET.

Red Jacket, Mich., will have a $30,000 sewer system.

The sewer system at Davenport, Iowa, will be extended.

Plans have been prepared for a $30,000 sewer in Akron, O.

Durango, Colo., has decided to construct a sewerage system.

Numerous sewer main extensions have been authorized at Rochester, N. Y.

The estimated cost of the proposed sewerage system at Derry, N. H is $55,579.97.

A stock company has been formed to construct a sewerage system for Mobile, Ala.

The city of Creston, Iowa, will have a sewerage system built along its streets and alleys.

Specifications and estimates have been prepared for the west-side sewer at Rochester, N. Y.

Redwood Falls, Minn., has prepared plans for a sewerage system estimated to cost $80,000.

Plans have been adopted for a sewer system for Salinas, Cal., estimated to cost about $30,000.

Sealed bids have been advertised for the work of constructing a masonry sewer about 40,000 feet in length at Salt Lake City, Utah. It will be from 42 to 64 inches internal diameter.

An appropriation of $15,000 has been voted for extending the sewer system of Westfield, Mass.

Plans are being prepared for a sewer system about eighteen miles in length in Charlottsville, Va.

The sewer committee of Hamilton, O., has authorized the construction of numerous additional sewers.

H. K. White, city clerk of Benicia, Cal., writes that the city wants bids for eight blocks of 10-inch pipe sewers.

The council of Council Bluffs, Ia., is considering plans and specifications of the city engineer for important sewer work.

A. B. Phillips, clerk of Ashtabula, Ohio, says the council has determined on additional sewerage to the amount of $22,000.

J. M. Kennedy, city clerk of Aurora, Ill., writes that about nine miles of sewers will be built in that city this fall or next spring.

F. W. Dalrymple, city engineer of Bradford, Pa., writes that about one mile of new sewers will be constructed during the season.

A map and plan of a permanent system of sewerage for Cortland, N. Y., has been prepared and approved by the state board of health.

Sealed bids will be received until May 16, 1893, for constructing sections A, B, C, D and E of the Lick Branch sewer at Nashville, Tenn.

The citizens of Ann Arbor, Mich., voted in favor of a sewerage system and will now bond for $30,000 and the main sewer will be built at once.

F. W. Allison, city clerk of Salem, Ohio, writes that a two-ring brick sewer, 2,500 feet long, will be built at once to serve as a trunk line sewer.

H. O. Rupert, city auditor of Fargo, N. Dak., writes that the city will receive bids until May 8 for the construction of additional sewerage.

Marinette (Wis.) people have voted to issue $60,000 worth of bonds to complete the sewer system and accomplish other important improvements.

Plans have been prepared for 10,000 feet of eight to twenty-four-inch pipe sewers, average cut nine feet, in Watertown, N. Y. Bids will soon be called for.

Ordinances providing for the construction of the following sewers at Cleveland, Ohio, passed the city council: Harlem street, between Willson avenue and Kirtland street; Sheriff street, between Bolivar and Eagle streets and Bright street, between Fountain and Noble alleys.

Menasha, Wis., is to have a sewer to extend from Lake Winnebago to Lake Butte des Mortes. It will be about a mile in length and will cost about $12,000.

The mayor of Reading, Pa., has signed ordinances providing for a complete system of sewerage, and appropriating $100,000 for a pumping station and disposal plant.

Plans have been prepared by F. Danforth for a system of six to twelve-inch pipe sewers. The council is considering an appropriation of $10,000 for the construction.

E. B. Parsons, city engineer of Fond du Lac, Wis., writes that the city is advertising for bids for 1,460 feet of 10-inch sewer in Ninth street and 420 feet in Fifth street.

The city of Tampa, Fla., is taking the initiatory steps to establish a sewerage system. Col. Geo. E. Waring is to make proper inspection of the facilities for proper drainage.

A sewer will be built in Clark street, Youngstown, Ohio. It will begin at the northerly end, near Mahoning river, thence southerly to Mahoning avenue, connecting with Mahoning avenue sewer.

The municipality of Cadiz, Spain, offers a premium of 30,000 peseta ($6,000), to the author of the best plan for a proposed sewerage system. The competition remains open until December, 20, 1893.

The finance committee of Jersey City, N. J., has approved the plans for the extension of the Ravine road sewer to the Hudson river; total length 6,700 feet, of which 5,600 feet will be 48-inch iron pipe; estimated cost, $84,326.

A resolution has been adopted by the city council of Toledo, Ohio, ordering the construction of a cylindrical brick sewer, twenty inches inside diameter and four inch shell, along center line of Michigan street, from sewer in Locust street to Walnut street.

Plans have been completed for the joint district sewer on South Grand avenue, Kansas City, Mo. It will follow Grand avenue to the Westport road and the Westport road to the city limits. It will empty into the O. K. creek sewer and the estimated cost is about $20,000.

Resolutions have been adopted by the city council of Columbus, Ohio, declaring it necessary to construct a main trunk sewer, beginning at a point on the east bank of the Scioto river and where the line of Morrell avenue extending west would intersect the same; thence east on said line to the bank of the Columbus feeder to the Ohio canal, eight feet inside diameter; thence continuing in same line east to the intersection of Morrell avenue and Fourth street, seven feet six inches inside diameter; also a branch main begin-

ning at the intersection of the above described main at Morrell avenue and South Fourth street, thence east with the center line of Morrell avenue to the center of Parsons avenue, four feet six inches inside diameter.

CONTRACTS AWARDED.

The contract has been let for a $7,800 sewer on Como avenue, St. Paul, Minn.

Messrs. Mitchell & Morgan, of Kingston, N. Y., were awarded the contract for the construction of a sewer system at Stamford, N. Y.

Christian Poock was the lowest bidder on the construction of pipe, brick and stone storm water sewers to take the place of the present Leely's ditch, which is to be filled up at Dayton, Ohio. The engineer's estimate was $53,000 and the lowest bidder was $43,862.

Mr. R. T. McDonald is the contractor who will build for the city of New Orleans a complete sewer system, to cost when completed $3,000,000. New Orleans has long been in need of a sewer system and the project is one which will require great skill in engineering as the city is extremely low.

Moulton & O'Mahoney have the contract for one of the largest and most important sections of the sewerage system at Providence, R. I. The contract provides for a sewerage aqueduct along the Woonasquetacket valley, and for a big main artery of sewers to traverse the central and tidewater districts of the entire city.

WATER-WORKS.

In Paris the drinking water used comes from the River Seine, but recently it has been recommended that the water should not even be used to sprinkle the streets, because when it dries the dirt carried in it in solution is so full of contagious germs.

New York city authorities have been strenuously working for purer water by means of a sanitary protection of the sources of supply, and the prevention of the pollution thereof by sewage and other matter tending to defile the supply. The villages in the vicinity of the Croton watershed have been visited, and many of the worst sources of pollution destroyed.

CONTEMPLATED WORK.

A water-works plant is proposed at Milan, Tenn.

The citizens of Washington, Kan., want water-works.

The water-works question is being agitated at Fayetteville, Tenn.

Figures and plans have been secured for water-works at Piedmont, W. Va. The estimate for complete works is $43,000.

Tower City, Pa., is to have a new water supply system.

Eastland, Texas, is endeavoring to secure water-works.

Plans for a water-works plant are being made for Kensington, Pa.

Gallipolis, Ohio, contemplates erecting a $60,000 water-works plant.

The city engineer of Petersburg, Va., estimates the cost of a 155,000,000 gallon reservoir at $30,000.

The water-works system at Cedar Rapids, Iowa, will be owned and operated by a non-resident corporation.

J. A. Crawford, city clerk of Benton Harbor, Mich., writes that an extra water supply, stand-pipe system, is under consideration.

The water commissioners of Binghamton, N. Y., estimate that a 6,000,000 gallon filtering plant could be put in for less than $50,000.

The water-works system at Grand Forks, N. D., will be enlarged and improved by the extension of new mains, and bids have been advertised for.

The citizens of Aurora, Ind., are now agitating the question of a water-works system. The expense is variously estimated at from $50,000 to $65,000.

The citizens of Hartford, Mich., are agitating the question of damming the Paw Paw river at that place for the purpose of obtaining water power for a system of water-works.

A goodly number of the Maryland towns are moving for new or improved water-works; among them are Frederick, Hagerstown, Cumberland, Cambridge, Crisfield and Middletown.

Water-works are contemplated at Manlius, N. Y., Rockport, Wash., Downsville, N. Y., Dothen, Ala, Coraopolis, Pa., Mount Vernon, Wash., Spanish Fork, Utah, Mount Kisco, N.Y., Goliad, Tex., Orrville, Ohio, and Oxford, Ala.

J. W. Buchanan, clerk of Chanute, Kan., writes that the city has voted $50,000 water-works bonds. As soon as satisfactory arrangements can be made with the Santa Fe Company in regard to their taking water of the city, the bonds will be issued.

Mr. E. F. Layman, of Cincinnati, reports that the village council of Wyoming, Ohio, has adopted the Van Vranken flush tank, and has ordered the construction of a number at once. The village has contracted to furnish the neighboring village of Hartwell with water, the quantity to be not less than 100,000 gallons in each twenty-four hours.

The Apollo Spring Water Company has contracted for twenty miles of pipe to supply Pittsburgh with pure water. The vein of water that will be drawn upon was discovered by the West Pennsylvania Gas Company while drilling for gas in Westmoreland county, and flows at the rate of 1,000 barrels daily. It will be brought to the heart of the city by pipe lines, thence distributed to the houses by cistern wagons.

The Chicago water-pipe line, which was originally started to connect the World's fair grounds with the springs at Waukesha, has been completed to and connected with the reservoir at Big Bend, within ten miles of Waukesha, where, it is claimed, water identical with that at Waukesha is to be had from a spring. The supply is ample for the World's Fair grounds, and it will be turned into the main in time for the opening of the fair.

W. E. Thomas, city clerk of Roanoke, Va., writes that the city council has appointed a committee in relation to the purchase of a large spring in the north suburbs for the purpose of erecting water-works and supplying the city with water. The spring and sixty acres of land have been offered to the committee for $60,000. The committee will recommend the purchase of the same, and the issuance of $150,000 of city bonds to erect water-works. The present water supply is owned by the Roanoke Gas and Water Company.

The Blue Lakes Water Company of Alameda, Cal., has a gigantic plan on foot for the supplying of water to various interior towns and cities in the northern portion of the state. The water of the company is mainly obtained from the Blue Lakes, which lie within Alpine and Amador counties. At present every town in Amador county receives its supply of water from this company and some 100 miles of canals and ditches have been constructed and soon the company expects to be able to furnish water to irrigate the northern portion of the San Joaquin Valley. When the scheme is fully under way, power will be supplied for electric plants.

CONTRACTS TO BE LET.

Victoria, Tex., will extend its system of water-works.

The village of Buchanan, Mich., will bond itself for $50,000 for water-works.

H. W. Sturtevant, clerk of Delavan, Wis., writes that plans and specifications are being made for a system of water-works for that village.

The water-power committee of the city council of Winnipeg, Man., will receive bids until June 3 for the construction of the works necessary to make available the water power of the Assiniboine river for the use of the city.

The village of Saranac Lake, N. Y., is to add to its advantages this summer new water-works and a complete system of sewers, costing several thousand dollars.

Sealed proposals for the construction of a system of public water-works will be received by the burgess of Somerset, Pa., until May 13. The plans cover both the gravity and pumping system, with a reservoir, and bidders may bid on one or both of them.

F. W. Dalrymple, city engineer of Bradford, Pa., writes that the councils have determined to put in an additional water supply, consisting of a 60,000,000 gallon reservoir, a new 16-inch supply main five miles long, and about three miles of additional pipe.

Water-works will be built at Southampton, N. Y.; Hillsboro, Ohio; Huntingburg, Ind.; Rockport, Mass.; Buchanan, Ill.; Karnes City, Tex.; Brewton, Ala.; Rock Mount, N. C.; Richmondville, N. Y.; Tower City, Pa.; Florence, Colo.; Raymond, N. H.; Greenfield, Ind.

S. H. Finley, city engineer of Santa Ana, Cal., writes that the city clerk has been authorized to advertise for bids for sinking a ten-inch artesian well to a depth of 600 feet to furnish water for the greatly increased number of patrons of the city water-works system.

Sealed proposals will be received by the water-works trustees of Clyde, Ohio, until May 9, for furnishing 7,108 lineal feet of four-inch pipe, also special castings, valves, valve boxes, fire hydrants, etc. Bids will also be received for the construction of a well according to plans and specifications.

P. A. Kinsley, clerk of council of Renovo, Pa., writes that the council has decided to reconstruct its reservoir by grouting the bottom and sides and erecting a stone wall on top of the side grouting. The work has been placed in charge of the water committee, which has begun operations. The basin will be 190 feet long and 200 feet wide. The improvement will cost $5,000.

CONTRACTS AWARDED.

The Williamsport (Pa.) Water Company has contracted for an immense pump with a capacity of 5,000,000 gallons daily.

The contract has been let to J. B. Neely, of Chattanooga, Tenn., for building water-works at Lexington, Ky. It is one of the largest contracts of the kind ever let in the south.

George T. Day, city clerk of Union City, Ind., writes that the contract for 1,250 feet of 6-inch water main on West Division street has been awarded to the Knapp Supply Company, of that city, at seventy-two cents per foot.

BRIDGES.

Defiance, Ohio, is going to have some new bridges.

Scurry county, Texas, is to have three new bridges.

A new bridge will soon span the Penobscott river at Bangor, Me.

A $50,000 bridge is to be built over the Great Miami, at Miamitown, O.

Plans have been submitted for the rebuilding of the Bluff street bridge at Kansas City, Mo. The estimated cost is $24,000.

Contract has been let for a 120-foot span, iron bridge, to be built across the Scioto river at La Rue, Ohio.

An iron bridge will span the Sequachee river at Alley, Tenn. It will be 160 feet span and is to cost $3,840.

Sealed bids will be received by the town clerk of Marysburg, Minn., until May 13, for the construction of a stone arch bridge.

A new bridge will soon be built over Alum creek just west of Westerville, Ohio. The legislature voted $25,000 for that purpose.

Plans, specifications and bids will be received on May 15 for the construction of an iron draw-bridge over the Alabama river near Montgomery, Ala.

An ordinance to appropriate $20,000 for the erection of the Fifteenth street bridge, Tacoma, Wash., has passed its third reading in the city council.

The Bullen Bridge Company has been awarded the contract for building the West Fourth street bridge and viaduct in Pueblo, Col., for $43,900.

A petition to the board of viewers and county commissioners has been filed for a free bridge across the Ohio river at Locust street, Allegheny, Pa.

B. F. Baker, town clerk of Brookline, Mass., writes that a new bridge is to be built over the railroad on Aspinwall avenue, at a cost of from $18,000 to $20,000.

C. P. Rogers, Jr., city clerk of Corry, Pa., writes that two iron bridges will probably be built this summer. One will have a sixty-foot span and the other a twenty-foot span.

Three bridges are wanted at Ottawa, Ill.; two to be built across the canal, one at Washington and one at Mulberry streets, and the other from Madison to Congress streets.

Nelson & Buchanan, of Chambersburgh, Pa., have been awarded the contract to erect a steel and iron county bridge at Cunningham's fording, Perry county, Pa., at their bid of $2,235.

The American Bridge Co., of Roanoke, Va., has closed a contract for the erection of a railroad bridge at Charleston, S. C., to be 105 feet in length. It also has the contract for building a bridge 108 feet long over the Leon river, at Gateville, Tex.

Dean & Westbrook, of New York, were awarded the contract for building the Second street bridge at Manchester, N. H. Charles A. Bailey, of Suncook, N. H., was awarded the contract for stone work. The bridge will be 186 feet over all and cost $59,187.36.

The Minneapolis committee on roads and bridges has recommended the building of a bridge this summer over the railroad tracks on Fourth street northeast. The Minneapolis improvement company northeast has volunteered to advance the money, $11,400, which is to be refunded July 1, 1894.

A 126-foot span Howe trestle bridge, thirty-eight feet above the water, across the Black Bear river, in Kansas, was burned recently, and Mr. Cross, of Wichita, had a bridge erected so that trains passed in less than twenty hours after the burning occurred. This is claimed to be the fastest bridge building record in the world.

The Missouri River Bridge Company has been incorparated at Sioux City, Iowa, with a capital stock of $2,500,000. The company has purchased the works and franchise of the Pacific Short Line Bridge Company, now constructing a common road and wagon bridge across the Missouri river at that place, and will complete it.

The city engineer has completed the plans for the Holton street bridge at Milwaukee, Wis. The opening will be sixty-five feet wide. The draw is quite different from anything of the kind in Milwaukee. The two ends of it fold up like a jack-knife, when the bridge is opened.

The new bridge being built over the Ohio river at Wheeling, W. Va., is one of mammoth proportions and will cost nearly $1,000,000. The width will be sixty feet, thirty feet of which will be taken up by a double track through the center. On either side of this there will be a ten-foot wagon-way and a five-foot walk for foot travelers. It will have five stone piers and two stone abutments.

Another bridge is to connect New York and Brooklyn, which, when completed, will make the Brooklyn bridge seem small by comparison. Its feeders will stretch out to great distances upon the east side of New York, and its span over the river will be much longer than that of the Brooklyn bridge. It will cost $25,000,000, and the contract provides that it must be finished during the present century.

STREET LIGHTING.

Margaretville, N. Y., is asking for electric lights.

A new electric light plant is now being built at Lexington, Ill.

Holly, N. Y., has appropriated $1,100 for electric street lighting.

Electric lights are badly wanted by the citizens of Rossville, Ill.

Medina, Ohio, will vote on $15,000 bonds for electric lights for the city.

The residents of Georgetown, Del., want the streets lighted by electricity.

The citizens of New Hampton and West Union, Iowa, want electric lights.

Madison, Me., has in view the erection of a municipal electric lighting plant.

An electric light plant is to be constructed at Snake Hill, N. J., at a cost of $135,000.

The question of lighting the streets of Attleboro, Mass., by electricity is being agitated.

Frank Mayfield, city clerk of Edinburgh, Ind., writes that an electric light plant is contemplated.

Macon, Ga., is contemplating a bond issue of $500,000 to pay for electric light and water-works.

The board of trustees of Palmyra, N. Y., has granted an electric light franchise to C. C. Hunt and B. H. Davis.

A. B. Phillips, clerk of Ashtabula, Ohio, writes that the capacity of the municipal lighting plant is to be increased.

A committee has been appointed in Weymouth, Mass., to investigate and report on the subject of electric street lighting.

Bonds will be issued to the amount of $50,000 to pay for the construction of an electric light plant at North Attleboro, Mass.

The Madera Electric Light Co., Madera, Cal., capital stock $100,000, has been incorporated, to build and construct an electric light plant.

The Royal Electric Water Co. has been formed at Lake Mills, Wis. The company will make a business of putting in electric light and water plants.

The Wiston Electric Company, of South Milwaukee, Wis., has secured a franchise for erecting an electric light plant, the probable cost to be about $25,000.

The Light, Heat and Power Company of New Albany, Ind., has contracted for a new 5,000 incandescent light dynamo in order to meet the rapidly increasing demand for incandescent lights.

A bill introduced by Mr. Chesley in the Minnesota Legislature, which is general in its terms, proposes to confer upon the authorities of villages the right to issue bonds for the construction of gas and electric light plants.

Electric light plants will be built at Holland, Mich.; Stockton, Cal., Paris, Tex.; Leadville, Col.; Niagara Falls, N. Y.; Meridian, Miss.; Birmingham, Ala.; New Castle, Ind,; Hillsdale, Mich.; Brownwood, Tex.; Barberton, Ohio; Millvale, Pa.

Frank R. Dougherty, city clerk of Eau Claire, Wis., writes that the council has instructed the mayor and clerk to contract for the putting in of an electric light plant to be owned by the city. The plant is to cost $23,000. The contract with the company now furnishing light expires July 27.

City engineer Cooper has prepared estimates of what it would cost the city of Superior, Wis., to put in an electric lighting plant. He figures the cost of the plant at $60,000, and says the lights could be furnished at a cost of twenty-one cents each per light, where it now costs forty cents. This will show a saving of $15,465.05 per year, which would soon pay for the plant.

Geo. H. Fister, city clerk of Elkhart, Ind., writes that bids were received for electric lighting from the Elkhart Electric and Railway Co., the Home Electric and Power Co. of Elkhart, and C. F. Mosier, of Indianapolis. The reductions on all lights placed within one block of the next nearest light, if the contract be given for more than two years, were: Elkhart Electric and Railway Co., 7 per cent.; Home Electric and Power Co., 10 per cent.; C. F. Mosier, 5 per cent. The Electric and Railway Co. agrees to light the city hall free of charge. All bids were referred to the gas committee.

PUBLIC PARKS.

A park is wanted at Crawfordsville, Ind.

Twenty-five thousand dollars is wanted by the board of park commissioners of Kansas City for improving Budd Park.

The committee on parks and public property at Portland, Oregon, are in search of a tract of land suitable for a city park.

The south side residents and tax-payers of Omaha, Neb., are greatly interested in the selection of a park site in the south end of the city.

The board of park commissioners of St. Paul will economize in the maintenance of parks this season and hope to be able to keep the parks in presentable condition at a cost of about $25,000.

Cheyenne, Wyo., is to have a new city park.

The park board of Seattle, Wash., contemplate improving Pioneer Place by building a pavilion, having an auditorium, store room and waiting room conveniently arranged for public speaking, etc.

Pueblo, Colo., is deeply interested in securing park sites for the city. Two donations of 160 acres each have been made to the city, on such conditions as to improvements and care as will not make them burdensome.

The committee on plans and improvements of Fairmount Park, Philadelphia, Pa., passed resolutions recommending the expenditures of $9,050 to renovate Greenland drive in Fairmount Park, and $2,500 for the purchase and planting of trees.

Topeka, Kan., is to have a new public park, and twenty acres of the fair ground will be devoted to this purpose. Twenty-five thousand dollars will be expended in laying out and improving it. An auditorium capable of seating 5,000 people will be erected.

The Quincy (Ill.) Boulevard and Park association has done much to give that city a good driving street and fine parks. It has placed a handsome park in the first ward and Madison park at Twenty-fourth and Main streets and will continue its efforts until Quincy is surrounded by a boulevard.

The park board, of Detroit, Mich., received a formal tender of a valuable piece of ground for park purposes. It is that part of the Cook farm between Jefferson avenue and the river front. The gift is in the shape of a deed, which contains stipulations that the city shall spend $1,000 annually for three years in beautifying the proposed park, and $500 a year for the next fifteen years.

Plans are under contemplation, which if carried out will make Riverside park, Sioux City, Iowa, one of the most attractive of summer resorts. It is proposed among other things, to erect a number of picturesques little two-room cottages that will add to rather than detract from the beauty of the grounds. Considerable landscape gardening and improving of roads and walks will also be done.

The board of public works of Milwaukee will ask the common council for permission to spend the following sums in sodding and planting flowers in the following parks: First ward, $50; Juneau, $200; court-house, $100; Fourth ward, $200; Grand avenue, $300; Walker, $100; Clarke, $50. For the intersections of Pryor avenue, Kinnickinnic avenue, Potter avenue and Elm street, Russell avenue and Lincoln avenue, the sum of $200 will be asked.

STREET RAILWAYS.

Frankfort, Ind., is negotiating for an electric railway.

There is talk of constructing a street railway in Van Buren, Ark.

An electric railway will be constructed at Michigan City, Ind., at a cost of $225,000.

There is talk of constructing a trolly line between Mechanicsburg and Harrisburg, Pa.

An electric street railway is projected between Eau Claire, Wis., and Chippewa Falls.

A franchise has been granted to the Rahway Electric Company for an electric railway at Rahway, N. J.

L. C. Kelsey, clerk of Elyria, Ohio, writes that the council has under consideration the construction of a street railway line.

Electric railways will be built at Napoleon, O.; Kalamazoo, Mich.; Norwalk, O.; Scranton, Pa.; Dayton, O., and Marion, Ind.

Franchises have been granted at Atlanta, Ga., to the Lithia Spring Railway Co., to construct ten miles of electric street railway.

An eastern syndicate has purchased the street railway system at Terre Haute, Ind., and will make improvements and extend the lines.

A company has been formed at Napoleon, Ohio, for the purpose of building an electric railway from Bryan to Ridgeville, Napoleon, Grand Rapids, Green Springs, Tiffin, Fostoria and Findlay.

Articles of incorporation have been filed at Trenton, N. J., and a charter granted for an electric railroad to run from Passaic to Bloomfield, Montclair, Verona and Caldwell, a distance of about ten miles. The company is capitalized at $200,000.

MUNICIPAL BONDS.

Louis Hock, Clyde, Ohio, invites bids up to May 9 for the purchase of $7,000 waterworks extension bonds and $12,000 electric light plant bonds.

Sealed bids will be received at the office of the county auditor, Cleveland, Ohio, until May 20, for the purchase of $160,000 five per cent. Cuyahoga County Brooklyn bridge bonds.

H. E. Lindsley, city clerk of Centralia, Wash., writes that that city will receive bids until 6 P. M. on Tuesday, May 9, on $22,750 funding bonds bearing 6 per cent. interest, each bid to be accompanied by a certified check for $5,000.

SOME LEADING ARTICLES IN RECENT NUMBERS OF PAVING AND MUNICIPAL ENGINEERING.

JANUARY, 1893.

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By Major James W. Howard, B. L., C. E.

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MAINTENANCE OF ROADS IN FRANCE.
By Arthur Lagron, C. E.

SPECIFICATIONS FOR BRICK PAVEMENTS.

FOUNDATION AND CONSTRUCTION OF BRICK PAVEMENTS.
By W. M. Whitten, C. E.

THE IMPORTANCE OF WIDE WHEEL TIRES.
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By Arthur Lagron, C. E.

ASPHALT OF TRINIDAD.
By W. P. Pierce.

MARCH, 1893.

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NOTES ON SEWAGE AND SEWERS.
By Louis H. Gibson.

ROAD ENGINEERING EXTRAORDINARY.
By John Charles King.

ORIGINAL RESPONSIBILITY OF CITY CIVIL ENGINEERS.
By Frank Knight.

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MORE OF A GOOD THING.

APRIL, 1893.

TRINIDAD ASPHALT DEPOSITS.
By Capt. Dolphus Torrey.

BURNED CLAY FOR ROADWAYS.
By A. W. Smith.

CEMENT SIDEWALKS, AND HOW THEY SHOULD BE MADE.
By E. L. Martin.

THE EVOLUTION OF THE BRICK MACHINE.
By Cyrus Chambers, Jr.

TWO METHODS OF GETTING DIRECT HIGH PRESSURE FROM WATER-WORKS PUMPS.
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SEALED PROPOSALS.

WATER-WORKS.

Sealed proposals for the construction of a system of public water-works will be received by the Borough of Somerset, Pa., until 8 o'clock P. M., on Saturday, May 13, 1893. The plans cover both the gravity and pumping systems, with a reservoir, and bidders may bid on one or both of them.

The town council reserves the right of rejecting any and all bids.

For specifications and requirements address

WM. H. WELFLEY, Burgess.

STREET LIGHTING.

Proposals to light the streets of the village of Flushing, Queen's County, N. Y., will be received by the Board of Trustees of said village, at their rooms in the Town Hall, until 8 P. M., on the sixth day of June, 1893.

For information and specifications apply to G. A. Roullier, Village Engineer, No. 20 Main street, Flushing, L. I.

Each bidder will be required to deposit with his proposal or proposals a certified check in the sum of $2,000.

The right is reserved to reject any or all bids.

By order of the Board of Trustees,

CLINTON B. SMITH, Clerk.

SEWER.

Proposals to construct in Myrtle avenue and certain abuting streets in the village of Flushing, New York, about 9,500 feet of pipe sewers ranging in size from nine inches to twenty-four inches, will be received by the Board of Trustees of the Village of Flushing, at their rooms in the Town Hall until 8 P. M. on the tenth day of May, 1893.

For specifications and information apply to G. A. Roullier, Village Engineer, at No. 20 Main street, Flushing, L. I.

A certified check in the sum of two thousand dollars must accompany each bid.

The right is reserved to reject any or all bids. By order of the Board of Trustees.

CLINTON B. SMITH, Clerk.

SEALED PROPOSALS.

REPAIRING MACADAMIZED ROADWAY.

Proposals, including the furnishing of material necessary, to repair about two miles of macadamized highway, known as the Jericho Turnpike, situated partly in the First and partly in the Second Divisions of Queens County, N. Y., will be received by the Board of Supervisors of said County at the "Asylum" Mineola, until 12 o'clock noon, on the ninth day of May, 1893.

For information and specifications apply to the Division Engineers as follows: For First Division, G. A. Roullier, 20 Main street, Flushing, L. I.; for Second Division, John J. McLaughlin, Fulton street, Jamaica, L. I. A certified check in the sum of $500 shall accompany each proposal. The right is reserved to reject any or all proposals.

By order of the Board of Supervisors, Queen's county, N. Y. ROBERT SEABURY, Clerk.

PUMPING PLANT.

Sealed bids for the pumping plant for the Metropolitan sewerage pumping station at East Boston and sealed bids for the pumping plant for the Metropolitan sewerage station at Deer Island will be received by the Board of Metropolitan Sewerage Commissioners at its office, 110 Boylston street, Boston, until 12 o'clock M., May 27. The board will provide at each pumping station an engine house, boiler house, chimney and masonry foundations for the pumps. The contractor's bid for each plant must be for furnishing, setting up and completing ready for use two pumping engines (or sets of engines), four boilers, piping and all necessary appliances and fittings such as are to be found in pumping stations of the best class. Each pumping engine must be capable of easily raising 70 cubic feet of sewage per second 19 feet vertically above the level of the sewage in its respective pump well. Each of the engines must also be capable of raising to greater lifts up to 25 feet quantities of sewage inversely proportional to such lifts. Each engine shall also be capable of pumping at as low a rate as 15 cubic feet per second and at all rates between 15 and 70 cubic feet per second.

H. KINGMAN.